REVISED
FIELD SAMPLING PLAN
BF GOODRICH SITE
RIALTO-COLTON GROUNDWATER BASIN
FIELD INVESTIGATION

SAN BERNARDINO COUNTY, CALIFORNIA

EPA CONTRACT NO. EP-S9-08-04
EPA TASK ORDER NO. 023-RICO-09JW
CH2M HILL PROJECT NO. 385219.FI.01

Prepared for
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Prepared by
CH2M HILL
1000 Wilshire Blvd., 21st Floor
Los Angeles, CA 90017

March 2009

REVISED
FIELD SAMPLING PLAN
BF GOODRICH SITE
RIALTO-COLTON GROUNDWATER BASIN
RI FIELD INVESTIGATION

SAN BERNARDINO COUNTY, CALIFORNIA

EPA CONTRACT NO. EP-S9-08-04
EPA TASK ORDER NO. 023-RICO-09JW
CH2M HILL PROJECT NO. 385219.FI.01

MARCH 2009

NONDISCLOSURE STATEMENT

This document has been prepared for the U.S. Environmental Protection Agency under Contract No. 68-W-98-225. The material contained herein is not to be disclosed to, discussed with, or made available to any persons for any reason without the prior expressed approval of a responsible official of the U.S. Environmental Protection Agency.

Contents

Section **Page**

Appendixes

Tables

Figures

Acronyms

°C	degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	contract laboratory program
COC	chain-of-custody
CRQL	Contract Required Quantitation Limit
DQO	Data Quality Objective
EC	electrical conductivity
EPA	United States Environmental Protection Agency
FSP	field sampling plan
HCl	hydrochloric acid
HPLC	high-pressure liquid chromatography
IDW	investigation-derived waste
L/min	liters per minute
MCL	maximum contaminant level
µg/L	micrograms per liter
mL	milliliter
mL/min	millimeters per minute
MP	multi-port
MS/MSD	matrix spike/matrix spike duplicate
NTU	Nephelometric Turbidity Unit
PARCC	precision, accuracy, representativeness, comparability, and completeness
PRP	potentially responsible party
QA	quality assurance
QAO	Quality Assurance Office
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control

RASP	Rialto Ammunition Backup Storage Point
RFA	request for analyses
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RSCC	Regional Sample Control Center
SOP	standard operating procedure
SOW	statement of work
TCE	trichloroethene
USGS	United States Geological Survey
VOA	volatile organic analysis
VOC	volatile organic compound
WCLC	West Coast Loading Corporation
WVWD	West Valley Water District

SECTION 1

Objectives

This Revised Field Sampling Plan (FSP) has been prepared to support field and laboratory activities associated with the field investigation to be conducted at the B.F. Goodrich Site in the eastern portion of the Rialto-Colton Basin (Figure 1-1 [note that all figures are inserted at the end of the text). The FSP has been revised to provide responses to EPA Quality Assurance Office (QAO) comments dated February 11, 2009. Responses to the QAO comments were prepared on February 26, 2009 and are included in Appendix C of this Revised FSP.

The field investigation work will involve the following activities: installation and sampling of up to 7 new Multi-port (MP) monitoring wells (Figure 2-1), sampling of existing conventional and MP monitoring wells, and installation of 3 soil borings, including collection of soil samples, construction of permanent, nested soil vapor probes in the soil borings, and soil gas monitoring. The field investigation work is intended to provide data for evaluation of the nature and extent of groundwater contamination at the B.F. Goodrich Site and of soil and soil gas contamination associated with one of the key source areas in the 160-Acre Area. Data Quality Objectives are presented in the Quality Assurance Project Plan for this field investigation (EPA, 2008a).

Previous groundwater sampling and analysis at the B.F. Goodrich Site and other portions of the Rialto-Colton Basin has shown that perchlorate and volatile organic compounds (VOCs), primarily trichloroethene (TCE), are present at concentrations exceeding State and/or Federal maximum contaminant levels (MCLs) in groundwater at and downgradient of the 160-Acre Area. Previous soil and soil-gas sampling and analyses in the 160-Acre Area have shown that perchlorate is present in the soil and volatile organic compounds (VOCs), primarily trichloroethene (TCE), are present in soil gas.

Previous sampling has been conducted by the United States Environmental Protection Agency (EPA), various water agencies and Potentially Responsible Parties (PRPs). Continued sampling at existing wells and installation of new wells, following standard EPA field, analytical and quality assurance/quality control (QA/QC) procedures, is recommended to further delineate the nature and extent of contamination and provide a larger dataset of known quality throughout the area of interest.

The data from the planned field investigation will be used to further evaluate one of the key source areas in the 160-Acrea area and to assess the distribution of contamination at the B.F. Goodrich Site in the eastern portion of the Rialto-Colton Basin. These data will support ongoing evaluation of contamination conditions and guide additional remedial investigation (RI) activities. Water level data will be collected to monitor groundwater flow directions and gradients.

EPA's general objectives for the remedial investigation/feasibility study (RI/FS) work at the B.F. Goodrich Site are to characterize the source areas and the nature and extent of contamination, then identify and evaluate appropriate remedial actions to address the contamination.

TABLE 1-1
Key CH2M HILL Project Personnel for RI Field Program Implementation
B.F. Goodrich Site RI/FS

Personnel	Title	Project Role	Phone Number
David Towell	Senior Project Manager	Project Management	(213) 228-8285
Yueh Chuang	Senior Project Manager	Senior Review	(714) 435-6165
Rick Cavil	Regional Health and Safety Manager	Health and Safety Management	(408) 896-0140
B.J. Lechler	Task Manager/Site Safety Coordinator	Field Program Management	(714) 435-6283
Vikas Mathur	Task Manager/Site Safety Coordinator	Field Program Management	(714) 435-6110
Jennifer Peterson	Database Analyst	Data Management	(480) 966-8577 x38287
Artemis Antipas	Quality Assurance Manager	Data Quality Assurance	(425) 453-5005 x5051
To be determined	Field Team Leader	Drilling, Soil Sampling, Well Installation, Soil Vapor Probe Installation	
Mike Ladeau	Field Team Leader	Groundwater and Soil Gas Monitoring	714/227-3324

SECTION 2

Site Background

This section provides a description of the Rialto-Colton Basin and the 160-Acre Area, and a brief history of the area. This section also provides a summary of prior investigations. Further details about the information contained in this section are provided in the Rialto-Colton RI Reports (GeoLogic, 2005, Geosyntec, 2005 and Geosyntec, 2006), and additional documents (refer to Section 8 for a listing of works cited).

2.1 Location

The 40-square mile Rialto-Colton Groundwater Basin is located in western San Bernardino County, California, about 60 miles east of Los Angeles, as shown on Figure 2-1. It is bounded on the northwest and southeast by the San Gabriel Mountains and the Badlands, respectively. The San Jacinto Fault and Barrier E form the northeastern boundary, and the Rialto-Colton Fault forms the southwestern boundary. The Santa Ana River cuts across the southeastern part of the basin, and Warm and Lytle Creeks join the Santa Ana River near the eastern edge of the basin. Except in the southeastern part of the basin, the San Jacinto and Rialto-Colton Faults act as groundwater barriers that impede groundwater flow into and out of the basin (United States Geological Survey [USGS], 1997). Barrier E generally does not impede groundwater flow into the basin.

Within the Rialto-Colton Basin, the 160-Acre Area is located in the southwest quadrant of Section 21, Township 1 North, and Range 5 West, of the USGS 7.5 minute series "Devore, California" quadrangle map. The site is square-shaped and bounded by West Casa Grande Drive on the north, Locust Avenue on the east, Alder Avenue on the west, and the extension of Summit Avenue on the south. Various buildings and structures are located throughout the site and several roadways run through the site, including West Lowell Street and other unimproved roads. The 160-Acre Area is now subdivided into smaller parcels with multiple property owners. Portions of the site are used for commercial and/or industrial purposes, and other areas are vacant or open space. The County of San Bernardino's Mid-Valley Sanitary Landfill is located immediately south and west of the 160-Acre Area. Adjacent properties to the north, east, west, and south are either undeveloped or developed with industrial facilities or residential buildings. Interstate I-210 is located approximately 0.5 miles to the south of the site, Interstate Freeway I-15 is approximately 1.5 miles to the northwest, and Interstate Freeway I-215 is located approximately 3 miles to the northeast. The Rialto Municipal Airport is approximately 1.5 miles south-southeast of the site.

2.2 Geology and Hydrogeology

Stratigraphic units in the Rialto-Colton basin consist of (USGS, 1997):

- unconsolidated dune sand (Holocene)
- river-channel deposits (Holocene)

- younger alluvium (Holocene)
- older alluvium (late Pleistocene)
- partly consolidated Tertiary to Quaternary continental deposits (late Pliocene and early Pleistocene)
- consolidated Tertiary continental deposits (Pliocene?)
- basement complex (pre-Tertiary)

The unconsolidated alluvial material that fills the Rialto-Colton Basin consists of sand, gravel, and boulders interbedded with lenticular deposits of silt and clay. The partly consolidated continental deposits, which consist of gravel, sand, silt, and clay, and are somewhat compacted, underlie the alluvial deposits as lenticular bodies. These deposits crop out in the Badlands, which form the southeastern boundary of the basin, and crop out at the base of the San Gabriel Mountains, which form the northeastern boundary of the basin. The consolidated continental deposits consist primarily of clay that contains lenses of compacted, cemented sand. These deposits underlie the partly consolidated alluvial deposits. The basement complex is composed of metamorphic and igneous rocks, and underlies the alluvial and continental deposits, cropping out in the San Gabriel Mountains (USGS, 1997).

The fine-grained beds within the basin do not separate the groundwater system into well-defined aquifers and confining beds (USGS, 1997). The groundwater system is divided into four water-bearing units: river-channel deposits and upper, middle, and lower water-bearing units. These water-bearing units may contain more than one stratigraphic unit. Lithologic logs indicate that subsurface materials are largely heterogeneous alluvium that consists of various thicknesses of interbedded gravel, sand, silt, and clay. The water-bearing units are unconfined to partly confined and are in hydraulic connection with one another (USGS, 1997). Consolidated deposits underlying the lower water-bearing unit are not part of the groundwater system.

The river-channel deposits are not present in the portions of the Basin where sampling will occur. The upper water-bearing unit is present throughout the Rialto-Colton basin. The unit consists of alluvial fan deposits that grade into older river-channel deposits near the Santa Ana River and Warm Creek. It underlies these river-channel deposits and is the uppermost unit throughout the rest of the basin. The alluvial fan deposits consist of coarse sand and gravel, cobbles, and boulders. In some areas, the upper water-bearing unit contains clay lenses. It ranges in thickness from about 120 feet to about 300 feet (USGS, 1997). This unit is unsaturated in the portion of the Basin being evaluated as part of this study.

The middle water-bearing unit is laterally extensive throughout the basin and primarily consists of coarse to medium sand and interbedded fine sand and clay. The deposits of the middle water-bearing unit are finer in the southeastern portion of the basin (USGS, 1997). The clay beds are more extensive in the northwestern part of the basin near the Rialto-Colton Fault. The middle water-bearing unit ranges in thickness from about 240 feet to about 600 feet, and is the thickest in the northwestern portion of the basin, south of Barrier J (USGS, 1997). The middle water-bearing unit is of primary interest for this characterization study. GeoLogic has separated the middle unit into three zones A (or Upper Aquifer), B (or Intermediate Aquifer) and C (or Regional Aquifer). The Upper Aquifer is dry throughout the area of interest. The Intermediate Aquifer exists beneath the 160-Acre Area where it is isolated from the Regional Aquifer by an aquitard that results in head differences of more than 100 feet between the two aquifers. The saturated thickness of the Intermediate Aquifer thins out to the southeast of the 160-Acre Area and the aquitard separating the two aquifers pinches out near Rialto's Well No. 2.

Groundwater generally moves from northwest to southeast in the middle and lower water-bearing units. Two major interior faults, Barrier J and an unnamed fault, affect groundwater movement (USGS, 1997). Groundwater moves across Barrier J in the unfaulted part of the groundwater system. The unnamed fault is a partial barrier to groundwater movement in the middle water-bearing unit and an effective barrier in the lower water-bearing unit. Water flows laterally across the unnamed fault above the saturated zone.

Major sources of recharge to the groundwater system are:

- underflow
- precipitation that collects in small streams that drain the San Gabriel Mountains and the Badlands or runs off the mountain front as sheet flow
- subsurface inflow
- imported water
- seepage loss from the Santa Ana River and Warm Creek
- infiltration of rainfall
- irrigation return flow

The primary component of discharge from the groundwater system is pumpage. Additional components of discharge include:

- underflow across the Rialto-Colton Fault to Chino Basin
- transpiration by phreatophytes along Warm Creek and the Santa Ana River
- seepage to the Santa Ana River and Warm Creek during wet years when the water levels in the upper water-bearing unit and the river-channel deposits rise above the base of the streambed

Long-term water levels in production wells reflect precipitation cycles. Water levels in wells north of Barrier J are not affected by stresses on the groundwater system south of the barrier, indicating that these two parts of the groundwater system are not well connected (USGS, 1997).

2.3 Site History

In aerial photographs taken in the 1930s, irrigated and non-irrigated agriculture appear to be the main land uses in developed areas of the Rialto-Colton basin. In 1942, the United

States (U.S.) Army acquired 2,822 acres of mostly undeveloped land for use as the "Rialto Ammunition Backup Storage Point" (RASP). The Army subsequently developed and operated on approximately 740 of the 2,822 acres. The 740-acre area includes most or all of the 160-Acre Area. The RASP included a network of rail spurs to store rail cars, bunkers adjacent to the rail spurs, approximately 20 earthen-covered concrete igloos, approximately four magazines used to store fuses and powder, and assorted buildings. The RASP was an inspection, consolidation, and storage facility for railcars transporting bombs, ammunition, and other ordnance to the Port of Los Angeles. The materials handled at the RASP likely included flares and other pyrotechnics containing perchlorate salts (SAIC, 2004).

In 1946, after World War II ended, the United States sold the RASP site property. Since then, a portion of the former RASP site has been, and continues to be, used by a variety of defense contractors, fireworks manufacturers, and others who use perchlorate in their manufacturing processes or in their products. From about 1952 to 1957, the West Coast Loading Corporation (WCLC) tested and manufactured pyrotechnic devices. In 1955 and 1956, WCLC manufactured two products, photoflash flares and "ground-burst simulators," containing potassium perchlorate and used its facility to dry ammonium perchlorate.

In 1957, B.F. Goodrich Corporation (Goodrich) purchased the 160-acre West Coast Loading site. From about 1957 to 1962, Goodrich conducted research, development, testing, and production of solid-fuel rocket propellant and solid-fuel missile and rocket motors containing ammonium perchlorate, used chlorinated solvents in its operations, and disposed of wastes in one or more onsite pits. Goodrich sold the property in 1966.

Since the 1960s, the 160-Acre Area has been used by a number of companies that manufactured or sold pyrotechnics, including Pyrotronics, Pyro Spectaculars, and American Promotional Events. Pyrotronics reportedly manufactured pyrotechnics containing potassium perchlorate and disposed of wastes in an impoundment later known as the "McLaughlin Pit." Pyro Spectaculars describes itself as a public display fireworks operator, wholesaler and importer/exporter of fireworks, and is also believed to have disposed of materials into the "McLaughlin Pit." American Promotional Events has tested and stored fireworks containing potassium perchlorate and, previously, burned defective/off-spec fireworks.

To the southwest of the 160-Acre Area are the storage igloos constructed as part of the RASP (known as the "former bunker area"). After closure of the RASP, the igloos were used by a variety of parties for storage. Most of the igloos were demolished in 1998 after the County of San Bernardino purchased the property for expansion of the Mid-Valley Sanitary Landfill. From 1999 through 2003, the County contracted with Robertson's Ready Mix, Inc. to perform "gravel washing operations" in the former bunker area. The County believes that the gravel washing operations contributed to a release of perchlorate to the groundwater system separate from the 160-Acre Area (GeoLogic, 2007).

Site Investigations

Between 2003 and 2008, numerous investigations were conducted to characterize potential releases of contaminants at the Site. Table 2-1 summarizes investigations that included collection and analysis of soil samples, collection and analysis of soil gas samples, the installation of groundwater monitoring wells, or the collection and analysis of groundwater samples.

Table 2-1
Soil, Soil Gas, and Groundwater Testing at and Downgradient of the 160 Acre Area
B.F. Goodrich Site RI/FS

Sample Collection Date(s)	Report Date	Consultant	Testing
Mar-03	4/11/2003	PES Environmental, Inc.	Analysis of approximately 30 soil samples to a maximum depth of 8' bgs in areas used by American Promotional Events - West, Inc. (APE). All samples analyzed for perchlorate; two samples analyzed for volatile organic compounds (VOCs).
Nov-03	12/15/2003	Kleinfelder, Inc.	Analysis of approximately nine soil samples from three trenches to a maximum depth of 10' bgs, and approximately six soil samples from a boring to a maximum depth of 50' bgs, in areas used by Pyro Spectaculars. All samples analyzed for perchlorate and VOCs.
Dec-03	1/6/2004	PES Environmental, Inc.	Analysis of approximately eight soil samples to a maximum depth of 8' bgs in an area used by APE, to further evaluate contaminated soil detected in Mar 2003 investigation.
Mar-04	4/20/2004	Locus Technologies	Analysis of approximately 46 soil samples from 11 locations, to a maximum depth of 15' bgs, in areas owned by Wong Chung Ming. All samples analyzed for perchlorate; approximately 22 samples analyzed for VOCs.
May - Aug 2004	3/24/2005	Geosyntec Consultants	Analysis of approximately 12 soil samples at eight locations, and 101 soil gas samples at 61 locations, to a maximum depth of 12' bgs in areas associated with former B.F. Goodrich operations. All soil and groundwater samples analyzed for perchlorate, VOCs, metals, NDMA, 1,4-dioxane, RDX, and selected anions. Installation and sampling of 18 temporary wells, installation and initial sampling of four permanent groundwater monitoring wells (PW-1 to PW-4), and installation of three piezometers (PW-2A to PW-4A).
Sept. 2004	2/10/2005	Environ International Corp.	Analysis of approximately 23 soil samples from 12 locations, and 96 soil gas samples from 47 locations, to a maximum depth of 12' bgs in areas associated with West Coast Loading Corp. Soil samples analyzed for perchlorate, VOCs, metals, NDMA, 1,4-dioxane, RDX, and other anions.
Dec 2004 - Jan 2005	4/15/2005	Kleinfelder, Inc.	Analysis of approximately 11 soil samples. Five samples from trenches to a maximum depth of 5' bgs. Six samples from two borings through the bottom of the former "McLaughlin Pit" to a maximum depth of 20' bgs. All soil samples analyzed for perchlorate. One composited sample analyzed for VOCs.
May-05	Jan-06	Blasland, Bouck & Lee, Inc	Analysis of approximately 51 soil samples from 22 locations at depths of five or ten feet bgs for perchlorate in the area where a buried pyrotechnic round was discovered in September 2003. Most samples also analyzed for VOCs, SVOCs, metals, PCBs, and explosives. Analysis of approximately 40 soil gas samples

Mar 2006 - Feb 2007	3/30/2007	Environ International Corp. and Adverus	Analysis of approximately 355 soil samples and 124 soil gas samples, in 28 study areas that may have been associated with West Coast Loading Corp activities, and additional areas associated with other operations on the 160 acre area. Soil samples to a maximum depth of 25' bgs, except in Study Areas 18, 28, 41 and 46, where deeper sampling occurred. Installation and initial sampling of three groundwater monitoring wells by Pyro Spectaculars (CMW-01, CMW-02, CMW-03) , and two wells by Emhart Industries (CMW-04 and CMW-05).
Apr-06	6/23/2006	Kleinfelder, Inc.	Analysis of approximately 23 soil samples from a trench or potholes in the area where a buried pyrotechnic round was discovered to a maximum depth of 8' bgs, and approximately 8 samples of stockpiled or excavated soils. Some samples also analyzed for metals.
April – July 2006	10/21/2006	Geosyntec Consultants	Installation and initial sampling of five groundwater monitoring wells downgradient of the 160 acre area (PW-5 through PW-9).
April 2007 - June 2007	7/27/2007	Kleinfelder, Inc.	Analysis of approximately 41 soil samples from approximately 14 locations at depths of up to 52 feet bgs for perchlorate in the area where a buried pyrotechnic round was discovered. Some samples also analyzed for metals.
May 2008 (also summarizes previous results)	9/4/2008	Kleinfelder, Inc.	Analysis of approximately nine soil samples from three borings at depths of up to 16.5 feet bgs for perchlorate, and approximately 20 soil samples from one deep boring at depths of up to 200 feet bgs for perchlorate.
Feb 2008 – Mar 2008	4/22/2008	DPRA	Installation and initial sampling of two groundwater monitoring wells by the City of Colton (CPW-16 and CPW-17).

Several of the investigations listed in Table 2-1 included the installation of groundwater monitoring wells and/or the collection and analysis of groundwater samples.

They include a 2004 investigation by Geosyntec Consultants on behalf of Goodrich Corp., summarized in the March 24, 2005 RI Report (Geosyntec, 2005), which included the installation of 4 wellbores, 18 temporary groundwater wells, 4 permanent groundwater monitoring wells, and 3 piezometers. The four permanent monitoring wells are on or bordering the 160-Acre Area, including one upgradient well (PW-1) and three downgradient wells (PW-2 through PW-4). Well locations are shown in Figure 2-1. These wells were all completed in the intermediate (B Zone) aquifer that is variably saturated. Three deeper piezometers were installed into the deeper regional aquifer (C Zone). The intermediate and regional aquifers are separated by a sequence of thin layers ranging in thickness from a few feet to more than 30 feet that act as aquitards, and significant groundwater elevation differences (over 150 feet) were observed between the two aquifers. The four wells and three piezometers were periodically monitored between 2004 and 2008, and the results were summarized in monthly reports prepared between May 2004 and March 2008 (Geosyntec, 2004 to 2008) EPA also sampled three of the wells in January 2008. The downgradient wells contain elevated concentrations of perchlorate and trichloroethylene (TCE), as discussed further below in Section 2.4.

In 2006, Geosyntec Consultants carried out a second groundwater investigation, and summarized the results in an October 21, 2006 Additional Interim RI Report (Geosyntec, 2006). The investigation builds upon previous investigations in and around the 160-Acre Area and was designed to further investigate hydrogeologic conditions in the vicinity and downgradient of the 160-Acre Area and to evaluate the areal and vertical extent of contaminants in groundwater, including perchlorate and TCE. The investigation consisted of the installation of five permanent MP groundwater monitoring wells (PW-5 through PW-9, see Figure 2-1). The deepest screens in these MP wells ranged from 667 to 817 feet below ground surface (bgs). The furthest downgradient well (PW-9) is more than 3 miles downgradient (i.e., southeast) of the 160-Acre Area and contains significantly elevated perchlorate and elevated TCE. The five wells were periodically sampled between August 2006 and February 2007, and the results were summarized in monthly reports (Geosyntec, 2008). EPA also sampled the five wells in January 2008.

In 2006, Environ International Corp. and Adverus carried out a groundwater investigation at the Site on behalf of Emhart Industries and Pyro Spectaculars. The results are summarized in a September 2008 Draft RI Report (Environ, 2008). The investigation included the installation of five monitoring well clusters, each containing three wells, in the middle portion of the 160-Acre Area. These well clusters, named CMW-01 through CMW-05, confirm the presence of elevated perchlorate and TCE in the middle of the 160-Acre Area. The five wells have been periodically sampled since 2006 and EPA sampled two of the five well clusters in January 2008.

In February 2008, DPRA carried out a groundwater investigation at the Site on behalf of the City of Colton. The investigation included the installation of two additional monitoring wells (CPW-16 and CPW-17). The two wells were sampled initially in February and March 2008.

Selected water supply wells near or potentially downgradient of the 160 acre area have also been sampled periodically for VOCs and perchlorate. The wells are owned by the City of Rialto, West Valley Water District, City of Colton, and Fontana Water Company.

In addition, several investigations focused on contamination at or downgradient of the former bunker area have been completed. The results of many of those investigations are summarized in a January 2005 Revised Draft Interim RI/FS Report prepared by GeoLogic Associates (Geologic, 2005). At the time the report was prepared, three phases of field investigation had been completed; and 18 groundwater monitoring wells installed. The report indicates that groundwater downgradient of the former bunker area had been impacted by elevated concentrations of perchlorate and multiple VOCs, including TCE (GeoLogic, 2005). Groundwater impacts extended approximately 1.6 miles downgradient of the former bunker area and reach depths of 600 feet below ground surface (200 feet below the groundwater table).

The report evaluated remedial alternatives to mitigate impacts to the City of Rialto production well Rialto-3 (Figure 2-1), and recommended intercepting the groundwater contaminant plume with a groundwater extraction system, ex-situ treatment, and delivery of treated water to the City’s municipal supply system (GeoLogic, 2005). The first phase of the remedy, installation of a groundwater treatment plant and connection of Rialto-3 to that plant was completed in 2006. Installation of additional extraction wells and treatment plant upgrades is ongoing.

2.4 Groundwater

Perchlorate is an anion whose salts have been used in solid rocket propellant, munitions, explosives, fireworks, and other applications. Perchlorate salts are highly soluble in water and dissociate completely. The resulting perchlorate anion is non-volatile, highly mobile, and chemically stable in typical groundwater environments. Perchlorate and TCE impacts to groundwater have been detected at and downgradient of the 160-Acre Area (Figure 2-2). Contamination in this part of the Basin was first detected in 1997 when samples from the West Valley Water District (WVWD) Well No. 22 detected perchlorate at 820 micrograms per liter (µg/L) or parts per billion (ppb). Ongoing investigations are being conducted on the 160-Acre Area with peak perchlorate concentrations detected as high as 10,000 µg/L. The State of California recently adopted an MCL for perchlorate of 6 µg/L. TCE has been detected at a peak concentration of 420 µg/L in groundwater beneath the 160-Acre Area. This compares to an MCL of 5 µg/L. Perchlorate has been detected in City of Rialto groundwater production wells Nos. 1, 2, 4, and 6 which pump from the Rialto-Colton Groundwater Basin downgradient of the 160-Acre Area.

The perchlorate contamination emanating at the 160-Acre Area has resulted in a groundwater plume extending several miles downgradient of the site. The downgradient and lateral extent of the plume has not been delineated, however elevated levels of perchlorate (290 µg/L) and TCE (7 µg/L) are present at MP monitoring well PW-9, located approximately 3 miles downgradient of the 160-Acre Area. Contamination at this location is present above the MCL at depths of more than 800 feet below ground. The new MP wells proposed as part of this investigation are intended to further characterize the lateral and vertical extent of contamination.

2.5 Soil

One objective of the field investigation is to further characterize the nature and vertical extent of soil and soil gas contamination associated with the Goodrich burn pit on the 160-Acre Area. Previous investigation work on the 160-Acre Area has been conducted by two consultants: Geosyntec and Environ. Within the 160-Acre Area, Goodrich had a disposal/burn pit that is referred to as "Burn pit Area C" by Geosyntec and as "Study Area 5" by Environ. Ammonium perchlorate along with TCE and/or other chlorinated solvents were possibly disposed of in the burn pit. Historic aerial photos indicate there were one or more adjacent and possibly overlapping unlined and uncovered burn pits. Wastes deposited in the burn pits, possibly impacting the soil, may have included (EPA, 2008b):

- Dust and other waste from the grinding of ammonium perchlorate;
- Waste generated from cleaning residual propellant (containing ammonium perchlorate and chlorinated solvent) from the mixing equipment
- Propellant waste generated during testing or other stages of production
- Waste propellant from a one-time operation to salvage Sidewinder rocket motor casings

In June 2004, Geosyntec completed four soil borings (RIA-01 to RIA-04) in Area C directly adjacent to three soil gas sampling locations where TCE was detected. Perchlorate was detected in all eight samples collected from the four borings. TCE was not detected in the eight samples, although the reporting limit was elevated in 3 of 8 samples (Geosyntec, 2005).

Perchlorate in Soil at Former Goodrich Burn Pit (June 2004)		
Sample ID	**Depth (ft bgs)**	**Perchlorate (ug/kg)**
RIA-01	6	450
	12	440
RIA-02	6	310
	12	280
RIA-03	6	37 J
	12	36 J
RIA-04	6	180
	12	630
Source: Geosyntec, 2005		

In April 2006, Environ collected and analyzed an additional 35 soil samples in the same area at depths of 5 to 25 feet bgs. Perchlorate was detected at 4 of 18 locations in 12 of 35 samples. TCE was not detected in the 20 samples analyzed (Environ, 2008).

Perchlorate Concentrations in Soil at the Former Goodrich Burn Pit (April 2006)		
Sample ID	**Depth (ft bgs)**	**Perchlorate (ug/kg)**
SB-C-01-S5	5	<20
SB-C-01-S20	20	<20
SB-C-01-S20P	20	<20
SB-C-01-S25	25	<20
SB-C-02-S5	5	<20
SB-C-02-S10	10	<20
SB-C-02-S15	15	<20
SB-C-02-S20	20	<20
SB-C-02-S25	25	<20
SB-C-03-S5	5	<20
SB-C-03-S10	10	<20
SB-C-03-S15	15	<20
SB-C-03-S20	20	<20
SB-C-03-S25	25	<20
SB-C-04-S5	5	750 J
SB-C-04-S10	10	720 J
SB-C-04-S15	15	170 J
SB-C-05-S5	5	<20
SB-C-05-S10	10	<20
SB-C-05-S15	15	28 J
SB-C-05-S20	20	39
SB-C-05-S25	25	64 J

SB-C-06-S5	5	300
SB-C-06-S10	10	370
SB-C-06-S15	15	760 J
SB-C-07-S5	5	<20
SB-C-07-S10	10	<20
SB-C-07-S15	15	<20
SB-C-07-S20	20	<20
SB-C-07-S25	25	<20
SB-C-08-S5	5	<20
SB-C-08-S10	10	<20
SB-C-08-S15	15	23 J
SB-C-08-S20	20	170
SB-C-08-S25	25	28 J
Source: Environ, 2008		

2.6 Soil Gas

In May and June 2004, Geosyntec carried out soil gas sampling activities targeted at the former Goodrich burn pit. TCE was detected in soil gas at three locations believed to overlie the former pit. No other VOCs were detected in soil gas at the three locations (EPA, 2008b). TCE was not detected at any of the other 58 locations from throughout the 160-Acre Area that were sampled by Geosyntec in May and June 2004 or in the 124 samples collected by Environ in 2006

VOCs in Soil Gas at Former Goodrich Burn Pit (Area C)			
Sample ID	**Depth (ft bgs)**	**TCE (ug/L)**	**Other VOCs**
SG-BP-09	6	0.2 J	ND
SG-BP-10	6	0.5 J	ND
SG-BP-13	6	1.7	ND
	12	0.3	ND
Source: Geosyntec, 2005			

SECTION 3

Rationale for Sample Locations and Laboratory Analyses

EPA is conducting this field investigation in the eastern portion of the Rialto-Colton Basin to provide data for evaluation of the nature and extent of contamination (both laterally and vertically) associated with the B.F. Goodrich Site and to further delineate conditions in one of the primary source areas in the 160-Acre Area. These data will support ongoing evaluation of contamination conditions and help determine the need for additional RI activities and accelerated implementation of remedial actions.

3.1 Groundwater Sampling

Previous groundwater sampling at the B.F. Goodrich Site has shown that perchlorate and VOCs (primarily TCE) are present at concentrations exceeding State and Federal MCLs in groundwater at and downgradient of the 160-Acre Area. For this field investigation, groundwater sampling is necessary at existing and proposed new locations to track the primary groundwater contaminants of concern, VOCs and perchlorate. VOC concentrations in groundwater will be compared to Federal and State MCLs as described in the QAPP (EPA, 2008a).

3.1.1 Sampling Locations

Figure 2-2 shows the locations of existing wells in the Rialto-Colton Basin and the approximate extent of TCE and perchlorate contamination in excess of the MCL at the B.F. Goodrich Site. Downgradient wells that fall within or near the interpreted extent of downgradient contamination are proposed for sampling. This includes MP monitoring wells PW-5 through PW-9 (each with between 5 and 7 individual monitoring ports); WVWD well WVWD-22 (former production well that is now split into and intermediate and regional monitoring wells); City of Rialto production wells Rialto-01, Rialto-02, and Rialto-04; and WVWD production well WVWD-11. In addition, sampling is proposed at selected monitoring wells located on the 160-Acre Area that have exhibited elevated contaminant concentrations in the past, including PW-2; PW-3; CMW-2A, CMW-2B, and CMW-2C (three-well cluster); and CMW-5A, CMW-5B, and CMW-5C (three-well cluster). Finally, one well is proposed for sampling to provide data on contaminant conditions upgradient of the 160-Acre Area- monitoring well PW-1. These wells are shown in Figure 2-2. Table 3-1 provides well construction information and January 2008 water quality results for the existing wells.

Up to 7 new MP monitoring wells (EPA-A, EPA-B, EPA-C, EPA-D, EPA-E, EPA-F, and EPA-G) are planned to be installed by EPA starting in first quarter 2009. Figure 2-1 shows the potential location of the seven wells on a Rialto-Colton basinwide map, along with existing monitoring wells downgradient of the 160-Acre Area. Based on a visual assessment of each general drilling area, specific potential drilling sites for the 7 new MP wells are shown on Figures 2-4 to 2-10. Most locations are in streets in developed residential/commercial areas.

Table 3-1

Well Construction and January 2008 Water Quality Data for Existing Wells to be Sampled

B.F. Goodrich Site RI/FS

Well Name	Top Screen	Bottom Screen	Total Depth	Wellhead Elevation	Water Levels Only	01/08 Perchlorate Conc. (ug/L)	01/08 TCE Conc. (ug/L)
Production Wells[1]							
Rialto-01	650	958	960	1535		1.2	0.83
Rialto-02	588	1000	1022	1508		61	4.2
Rialto-04	355	878	890			NA	NA
WVWD-11	310	787	828			NA	NA
Conventional Monitoring Wells							
WVWD-22 Intermed.	440					73	19
CMW1A	428	448		1654.34	X	NA	NA
CMW1B	470	490		1654.3	X	NA	NA
CMW1C	513	533		1654.31	X	NA	NA
CMW2A	432	452		1655.68		24	18
CMW2B	471	491		1655.68		2.2	3.3
CMW2C	511	531		1655.66		ND	0.87
CMW3A	419	439		1665.2	X	NA	NA
CMW3B	459	479		1665.19	X	NA	NA
CMW3C	504	524		1665.19	X	NA	NA
CMW4A	400	420		1657.9	X	NA	NA
CMW4B	455	475		1658.02	X	NA	NA
CMW4C	490	510		1657.96	X	NA	NA
CMW5A	400	420		1647.9		170	180
CMW5B	460	480		1648.07		93	87
CMW5C	500	520		1648.08		51	11
PW-1	440	480	480	1704.48		ND	ND
PW-2	455	495	500	1639.36		4.1	13
PW-2A	622	642	642	1639.58	X	NA	NA
PW-3	456	496	501	1611.81		99	92
PW-3A	606	626	626	1611.81	X	NA	NA
PW-4	470	510	515	1626.56	X	NA	NA
PW-4A	638	648	648	1626.56	X	NA	NA
TW-1	444	474		1644.13	X	NA	NA
MP Monitoring Wells							
PW-5a	465	475	720	1423.64		160	23
PW-5b	510	520				130	20
PW-5c	555	565				1,000	27
PW-5d	615	625				ND	0.86
PW-5e	670	680				ND	ND
PW-6a	440	450	720	1409.16		2.9	ND
PW-6b	475	485				2.3	ND
PW-6c	520	530				2.9	ND
PW-6d	600	610				ND	ND
PW-6e	655	665				ND	ND
PW-7a	430	440	850	1401.14		9.9	ND

Table 3-1
Well Construction and January 2008 Water Quality Data for Existing Wells to be Sampled
B.F. Goodrich Site RI/FS

Well Name	Top Screen	Bottom Screen	Total Depth	Wellhead Elevation	Water Levels Only	01/08 Perchlorate Conc. (ug/L)	01/08 TCE Conc. (ug/L)
PW-7b	495	505				9.9	1.1
PW-7c	565	575				1.8	ND
PW-7d	635	645				3.5	ND
PW-7e	685	695				1.5	ND
PW-7f	750	760				ND	ND
PW-7g	815	825				ND	ND
PW-8a	440	450	808	1515.42		81	20
PW-8b	545	555				13	1.6
PW-8c	645	655				ND	ND
PW-8d	720	730				ND	ND
PW-8e	770	780				ND	ND
PW-9a	350	360	908	1304.16		3.1	ND
PW-9b	410	420				21	0.63
PW-9c	480	490				370	8.8
PW-9d	560	570				ND	ND
PW-9e	645	655				ND	ND
PW-9f	715	725				150	3.6
PW-9g	805	815				210	3.7

Notes: (1) The production wells are actually completed with multiple screened intervals, only the shallowest and deepest screened depths are posted.

1st, 2nd, and in some cases 3rd choice locations are shown for each well, based on proximity to the preferred drilling location, the availability of space for drilling and ancillary equipment, the presence of utilities and power lines, the relative amount of traffic on the street, and the likely level of disturbance to nearby residences and businesses. The preference is to install the new MP wells in public right-of-ways, rather than on private property.

The new MP monitoring wells are intended to better define groundwater flow directions and the lateral and vertical extent of contamination downgradient of the 160-Acre Area. Most of the proposed locations for new wells are in an area 3 to 4.5 miles downgradient of the 160-Acre Area, beyond the currently delineated extent of contamination. Each of the new MP wells will be approximately 900 feet deep and have 5 monitoring zones.

Following is a description of the 7 proposed new MP well locations, their purpose and priority:

Well EPA-A (Ayala Drive and Cheshire Street- Figure 2-4) is located to better define the eastern extent of groundwater contamination downgradient of the 160-Acre Area and is located near where the Intermediate and Regional Aquifers merge. This well will be one of the first wells installed.

Well EPA-B (Cactus Avenue near Madrona Street- Figure 2-5) is located to better define the western extent of groundwater contamination between PW-7 and PW-9 (Figure 2-2) and to help understand the difference in the levels of contamination between City of Rialto production wells: Rialto-04 and Rialto-05. This well will be one of the first wells installed.

Well EPA-C (Willow Avenue near Winchester- Figure 2-6) is located to better define the eastern extent of groundwater contamination downgradient of the 160-Acre Area. This well may not be needed if EPA-A does not show significant levels of contamination.

Well EPA-D (Willow Avenue, just south of Foothill Boulevard- Figure 2-7) is one of several wells being considered downgradient of PW-9 to determine the extent of contamination and direction of groundwater flow. This well anticipates groundwater flow directions turning more southerly downgradient of PW-9.

Well EPA-E (Acacia Avenue, just south of Foothill Boulevard- Figure 2-8) is one of several wells being considered downgradient of PW-9 to determine the extent of contamination and direction of groundwater flow. The well is located along the flow path between PW-9 and Colton monitoring well CPW-16 (Figure 2-1).

Well EPA-F (Etiwanda Avenue, just east of Acacia Avenue- Figure 2-9) is one of several wells being considered downgradient of PW-9 to determine the extent of contamination and direction of groundwater flow. Intended to define the eastern extent of contamination, but is a lower priority if EPA-C (if installed) does not have significant levels of contamination.

Well EPA-G (Spruce Avenue, just north of Foothill Boulevard- Figure 2-10) is one of several wells being considered downgradient of PW-9 to determine the extent of contamination and direction of groundwater flow. This well may be moved further west/northwest if water level data from EPA-B and other wells indicate more southerly or southwesterly flow directions. This well may not be needed if EPA-B has low levels of contamination.

After each of the new MP wells are constructed, their as-built well specifications will be added to the list Table 3-1. Water levels will be measured in all monitoring wells listed in Table 3-1. Note that several of the monitoring wells included in Table 3-1 are proposed for collection of water level data only (no sampling) to facilitate preparation of groundwater level contour maps. Consistent with prior measurements by EPA and others at this site, static water levels will be reported to the nearest 0.01 feet.

3.1.2 Number of Samples

The existing wells to be monitored are shown in Table 3-1. As noted in the table, some of the wells will only be used for water level monitoring, not sample collection. In addition to the normal environmental groundwater samples to be collected from each well, field quality assurance (QA) samples will be collected in the form of field duplicates, equipment blanks (or field blanks), and matrix spike/matrix spike duplicate (MS/MSD) double volume samples.

One field duplicate will be collected for every 10 wells sampled. Duplicate samples will be collected from what has is expected to be a moderately contaminated well. Equipment (rinsate) blank samples will be collected to check for possible cross-contamination of groundwater samples after decontamination of common equipment used to collect samples from a number of different wells in a given day. On any day where equipment decontamination is not required (e.g., for sampling production wells or monitoring wells with dedicated pumps), a field blank sample will be collected to check for the possible cross-contamination of groundwater samples from the point of sample collection to the analysis of the samples by the laboratory. One blank sample will be collected per day for all analytes. Laboratory quality control (QC) samples (MS/MSDs) will be collected for all analyses. One MS/MSD sample will be collected for every 20 samples collected. Table 3-2 summarizes the proposed groundwater samples to be collected per sampling event:

TABLE 3-2
Groundwater Sample Collection Summary
B.F. Goodrich Site RI/FS

Well Types	Sample Locations	Field Duplicate Locations	Blanks	Total Samples	MS/MSDs (1 per 20)
Existing Well Event (1Q 2009)					
MP Wells (5 wells)	29	3			
Monitoring Wells	10	1	9	56	3
Production Wells	4	0			
New MP Well Event (4Q 2009)					
MP Wells (up to 7 wells)	35	4	7	46	3
Existing and New MP Well Events (1Q 2010 and 1Q 2011)					
MP Wells (12 wells)	64	7			
Monitoring Wells	10	1	16	102	6
Production Wells	4	0			

3.1.3 Laboratory Analyses

Based on prior analytical results from sampling conducted by EPA and others at the B.F. Goodrich Site, all groundwater samples will be analyzed for VOCs and perchlorate to provide data for evaluating the nature and extent of groundwater contamination at and downgradient of the 160-Acre Area. Reporting limits must be lower than the MCLs, which are 5 µg/L for TCE and 6 µg/L for perchlorate.

3.2 Soil Sampling

Based on earlier investigation activities in the vicinity of the Goodrich burn pits, additional soil sampling is necessary to characterize the vertical extent of residual perchlorate contamination in this known source area. Consistent with prior investigations of perchlorate concentrations in soil at the Site, a reporting limit of 0.02 mg/kg will be used.

Figure 2-11 shows the locations of the 3 proposed soil borings (EPASB-01, EPASB-02, and EPASB-03). The soil borings are located in the apparent location of the former burn pits, in the west-central portion of the 160 Acre Area. Specifically, EPASB-01 will be located adjacent to Environ soil boring SB-C-06, EPASB-02 will be located adjacent to Environ soil boring SB-C-04, and EPASB-03 will be located approximately 50 to 75 feet southwest of Environ boring SB-C-04.

All 3 soil borings are assumed to be 100-feet deep and will have one soil sample collected in each 10-foot depth interval. The sonic drilling method will produce a continuous soil core of the borehole. Based on a visual assessment of the continuous core, the location within each 10-foot depth-interval that contains the highest percentage of finer-grained materials (including fine-grained sands) will be targeted for sample collection.

TABLE 3-3
Soil Sample Collection Summary
B.F. Goodrich Site RI/FS

Soil Borings	Sample Locations	Field Duplicate Locations	Blanks	Total Samples	MS/MSDs (1 per 20)
3 borings	30	3	5	38	2

3.3 Soil Gas Sampling

Based on historic soil gas data from the burn pit area, additional soil gas sampling is necessary to delineate the potential extent of TCE contamination in soil vapor beneath the Goodrich burn pits. VOC analytical results from soil gas will be compared to 10 times the regional screening levels as described in the QAPP (EPA, 2008a). For TCE in soil gas, a reporting limit of 0.2 or 0.4 ppb will be used.

Permanent soil vapor probes will be installed in each of the three planned soil borings, EPASB-01, EPASB-02, and EPASB-03. Figure 2-11 shows the locations of the 3 proposed soil borings. Unless lithologic variations suggest that alternative probe depths are warranted, the gas probes will be installed at 25-foot intervals in each boring- 25, 50, 75 and 100-feet below ground.

TABLE 3-3
Soil Gas Sample Collection Summary
B.F. Goodrich Site RI/FS

Soil Vapor Probes	Sample Locations	Field Duplicate Locations	Blanks	Total Samples	MS/MSDs
12 probes (4 per boring)	12	1	2	15	0

3.4 Investigation-Derived Wastes

Liquid and solid investigation-derived wastes (IDW) will be generated during drilling, well development, and sampling of the proposed monitoring wells and during drilling of the soil borings. Each of these wastes may potentially be contaminated with VOCs or perchlorate. Samples of the drill cuttings, drilling fluids and development water will be collected from the various storage bins and tanks to evaluate the proper storage, disposal, or discharge requirements for the IDW materials. The following subsections describe each of the wastes and the sampling procedures that will be used to characterize the wastes.

3.4.1 Drill Cuttings and Fluids

Drill cuttings and fluids will be generated during drilling of the monitoring wells and soil borings. The drill cuttings will be contained in roll-off bins stored at each well site. Two composite grab samples will be collected from the drill cuttings from each new MP well and boring. The MP wells are being installed in residential and commercial areas and would not be expected to generate contaminated cuttings. The soil borings will be located in a historic source area; however, prior sampling has indicated that residual soil contamination is relatively limited. Composite samples will be collected from representative cuttings of the dominant soil types encountered during drilling at each location.

Drilling fluids (water and bentonite) will be containerized in Baker tanks or equivalent and stored onsite at each MP well location. One composite sample of drilling fluid will be collected per MP well. It is likely that the drilling fluid in each tank will be fairly homogeneous as a result of recirculation, mixing, and agitation during the drilling process. Thus, one sample should be sufficient to characterize the fluids from each well. Because drilling fluid tends to separate into the heavier mud at depth and lighter water near the top of the tank, the sampling bailer will be lowered near the bottom of the Baker tank to collect a fluid sample with a high solids content.

The drill cuttings and fluids will be analyzed for the following, in accordance with typical disposal facility requirements:

- pH
- Flashpoint
- Total Petroleum Hydrocarbons – gasoline (TPHg)
- Total Petroleum Hydrocarbons – diesel (TPHd)
- Total Petroleum Hydrocarbons – motor oil (TPHm)
- VOCs
- Perchlorate
- Total threshold limit concentration (TTLC) Metals

A quick turn-around time (7 days) will be necessary for characterization and disposal of the drill cuttings and fluids to avoid additional costs associated with long-term storage of the wastes.

3.4.2 Development and Purge Water

During development of the MP wells and sampling of the existing monitoring wells, water will be generated that has the potential to be contaminated. Water generated from well development activities will be contained in Baker, or equivalent, tanks, stored temporarily onsite at each MP well location. One groundwater sample per well will be collected. It is likely that the development water from each well will be fairly homogeneous as a result of mixing and agitation during the well development processes. Thus, one sample per well should be sufficient to characterize the well development fluids. When collecting the sample from a tank, the sampling bailer will be lowered to the middle of the column to avoid any water that may have been affected by evaporation at the top of the water column.

Purge water from sampling of existing monitoring wells will be stored in a tank at a designated staging location. At the completion of each existing well sampling event, a single composite purge water sample will be collected from the storage tank using a bailer. Well development and purge water samples will be analyzed for the following:

- pH
- Flashpoint
- Total Petroleum Hydrocarbons – gasoline (TPHg)
- Total Petroleum Hydrocarbons – diesel (TPHd)
- Total Petroleum Hydrocarbons – motor oil (TPHm)
- VOCs
- Perchlorate
- Total threshold limit concentration (TTLC) Metals

The rationale for the chemical analyses listed above is based on review of regulatory levels, as described in the companion QAPP (EPA, 2008a) and on past experience with local disposal facilities. A quick turn-around time (7 days) will be requested for characterization of IDW samples to reduce the costs associated with long-term storage of the wastes.

SECTION 4

Request for Analyses

4.1 Groundwater

This section presents the requests for analyses (RFAs) for groundwater, soil, soil gas, and investigation derived waste (IDW) sampling that will occur during the field investigation. Laboratory analyses will be provided by the EPA Region 9 Laboratory and/or through the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) SOM01.X. Summaries of the analytical parameters and target reporting limits, and regulatory goals for the samples are provided in the QAPP (EPA, 2008a).

There will be three different types of groundwater monitoring events conducted as part of the field program:

- Existing monitoring wells (1st Quarter 2009) (Table 4-1)
- New MP monitoring wells (4th Quarter 2009) (Table 4-2)
- Existing wells and new MP wells (1st Quarter 2010 and 2011) (Table 4-3)

Tables 4-1, 4-2 and 4-3 present information required in the field regarding the specific analyses requested, preservatives, container requirements, and holding times for samples collected during the three types of groundwater monitoring events. Appendix A presents the draft Regional Sample Control Center Form provided for planning purposes.

For each of the new MP wells, the first groundwater sampling event will occur at least 1 month after Westbay system installation to allow the aquifer time to equilibrate. At a minimum, a single sampling event that will include all of the new MP wells is planned for late 2009 (Table 4-2). Depending on the timing and progress of MP well installation, there may also be an earlier sampling event conducted in mid-2009 for whichever of the new wells are completed at that time.

In the first quarter of 2009, existing monitoring and production wells will be sampled. The list of existing wells to be sampled (see Table 4-1) is the same as those wells sampled by EPA in January 2008.

In the first quarters of 2010 and 2011, a single, combined sampling event will be conducted that will include both the existing wells and the new MP wells (Table 4-3).

TABLE 4-1
Analyses Requested for Groundwater Samples – Existing Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
PW-5a	Lab QC	Day 1	Low	1	1
PW-5b	Dup.	"	"	2	2
PW-5c		"	"	1	1
PW-5d		"	"	1	1
PW-5e		"	"	1	1
PW-6a		Day 2	"	1	1
PW-6b		"	"	1	1
PW-6c		"	"	1	1
PW-6d		"	"	1	1
PW-6e		"	"	1	1
PW-7a		Day 3	"	1	1
PW-7b	Dup.	"	"	2	2
PW-7c		"	"	1	1
PW-7d		"	"	1	1
PW-7e		"	"	1	1
PW-7f	Lab QC	"	"	1	1
PW-7g		"	"	1	1
PW-8a	Dup.	Day 4	"	2	2
PW-8b		"	"	1	1
PW-8c		"	"	1	1
PW-8d		"	"	1	1
PW-8e		"	"	1	1
PW-9a		Day 5	"	1	1

TABLE 4-1
Analyses Requested for Groundwater Samples – Existing Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**VOCs**	**Perchlorate**
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
PW-9b		"	"	1	1
PW-9c		"	"	1	1
PW-9d		"	"	1	1
PW-9e		"	"	1	1
PW-9f		"	"	1	1
PW-9g		"	"	1	1
PW-1		Day 6	"	1	1
PW-2		"	"	1	1
PW-3		"	"	1	1
CMW-2A	Lab QC	Day 7	"	1	1
CMW-2B		"	"	1	1
CMW-2C		"	"	1	1
CMW-5A	Dup.	Day 8	"	2	2
CMW-5B		"	"	1	1
CMW-5C		"	"	1	1
WVWD-22 (Intermediate)		Day 9	"	1	1
WVWD-11		"	"	1	1
WVWD-24		"	"	1	1
Rialto-01		"	"	1	1
Rialto-02		"	"	1	1
Blank	Equip.	Day 1	"	1	1
Blank	Equip.	Day 2.	"	1	1
Blank	Equip.	Day 3	"	1	1
Blank	Equip.	Day 4	"	1	1

TABLE 4-1
Analyses Requested for Groundwater Samples – Existing Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
Blank	Equip.	Day 5	“	1	1
Blank	Equip.	Day 6	“	1	1
Blank	Equip.	Day 7	“	1	1
Blank	Equip.	Day 8	“	1	1
Blank	Field.	Day 9	“	1	1
TOTAL SAMPLES				**56**	**56**

Notes:
Lab QC samples will be three times the normal sample volume.
Dup. = Duplicate sample collected.

TABLE 4-2
Analyses Requested for Groundwater Samples– New MP Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
EPA-Aa	Dup	Day 1	"	2	2
EPA-Ab	Lab QC	"	"	1	1
EPA-Ac		"	"	1	1
EPA-Ad		"	"	1	1
EPA-Ae		"	"	1	1
EPA-Ba		Day 2	"	1	1
EPA-Bb		"	"	1	1
EPA-Bc		"	"	1	1
EPA-Bd		"	"	1	1
EPA-Be	Dup	"	"	2	2
EPA-Ca		Day 3	"	1	1
EPA-Cb		"	"	1	1
EPA-Cc		"	"	1	1
EPA-Cd		"	"	1	1
EPA-Ce		"	"	1	1
EPA-Da		Day 4	"	1	1
EPA-Db		"	"	1	1
EPA-Dc		"	"	1	1
EPA-Dd		"	"	1	1
EPA-De	Dup	"	"	2	2
EPA-Ea		Day 5	"	1	1
EPA-Eb		"	"	1	1
EPA-Ec		"	"	1	1

TABLE 4-2
Analyses Requested for Groundwater Samples– New MP Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
EPA-Ed		"	"	1	1
EPA-Ee		"	"	1	1
EPA-Fa	Lab QC	Day 6	"	1	1
EPA-Fb		"	"	1	1
EPA-Fc		"	"	1	1
EPA-Fd		"	"	1	1
EPA-Fe	Dup	"	"	2	2
EPA-Ga		Day 7	"	1	1
EPA-Gb		"	"	1	1
EPA-Gc		"	"	1	1
EPA-Gd		"	"	1	1
EPA-Ge		"	"	1	1
Blank	Equip.	Day 1	"	1	1
Blank	Equip.	Day 2.	"	1	1
Blank	Equip.	Day 3	"	1	1
Blank	Equip.	Day 4	"	1	1
Blank	Equip.	Day 5	"	1	1
Blank	Equip.	Day 6	"	1	1
Blank	Equip.	Day 7	"	1	1
TOTAL SAMPLES				**46**	**46**

Notes:
Lab QC samples will be three times the normal sample volume.
Dup. = Duplicate sample collected.

TABLE 4-3
Analyses Requested for Groundwater Samples – Existing Wells and New MP Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**VOCs**	**Perchlorate**
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
PW-5a	Lab QC	Day 1	Low	1	1
PW-5b	Dup.	"	"	2	2
PW-5c		"	"	1	1
PW-5d		"	"	1	1
PW-5e		"	"	1	1
PW-6a		"	"	1	1
PW-6b		Day 2	"	1	1
PW-6c		"	"	1	1
PW-6d		"	"	1	1
PW-6e		"	"	1	1
PW-7a		"	"	1	1
PW-7b	Dup.	"	"	2	2
PW-7c		Day 3	"	1	1
PW-7d		"	"	1	1
PW-7e		"	"	1	1
PW-7f	Lab QC	"	"	1	1
PW-7g		"	"	1	1
PW-8a	Dup.	"	"	2	2
PW-8b		Day 4	"	1	1
PW-8c		"	"	1	1
PW-8d		"	"	1	1
PW-8e		"	"	1	1
PW-9a		"	"	1	1
PW-9b		"	"	1	1
PW-9c		Day 5	"	1	1

TABLE 4-3
Analyses Requested for Groundwater Samples – Existing Wells and New MP Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
PW-9d		"	"	1	1
PW-9e		"	"	1	1
PW-9f		"	"	1	1
PW-9g		"	"	1	1
PW-1		Day 6	"	1	1
PW-2		"	"	1	1
PW-3		"	"	1	1
CMW-2A	Lab QC	Day 7	"	1	1
CMW-2B		"	"	1	1
CMW-2C		"	"	1	1
CMW-5A	Dup.	Day 8	"	2	2
CMW-5B		"	"	1	1
CMW-5C		"	"	1	1
WVWD-22 (Intermediate)		"	"	1	1
WVWD-11		Day 9	"	1	1
WVWD-24		"	"	1	1
Rialto-01		"	"	1	1
Rialto-02	Dup.	"	"	2	2
EPA-Aa	Dup	Day 10	"	2	2
EPA-Ab		"	"	1	1
EPA-Ac		"	"	1	1
EPA-Ad		"	"	1	1
EPA-Ae		"	"	1	1
EPA-Ba	Lab QC	Day 11	"	1	1

TABLE 4-3
Analyses Requested for Groundwater Samples – Existing Wells and New MP Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**VOCs**	**Perchlorate**
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
EPA-Bb		"	"	1	1
EPA-Bc		"	"	1	1
EPA-Bd		"	"	1	1
EPA-Be	Dup	"	"	2	2
EPA-Ca		Day 12	"	1	1
EPA-Cb		"	"	1	1
EPA-Cc		"	"	1	1
EPA-Cd		"	"	1	1
EPA-Ce		"	"	1	1
EPA-Da		Day 13	"	1	1
EPA-Db		"	"	1	1
EPA-Dc		"	"	1	1
EPA-Dd		"	"	1	1
EPA-De	Dup	"	"	2	2
EPA-Ea		Day 14	"	1	1
EPA-Eb		"	"	1	1
EPA-Ec		"	"	1	1
EPA-Ed		"	"	1	1
EPA-Ee		"	"	1	1
EPA-Fa	Lab QC	Day 15	"	1	1
EPA-Fb		"	"	1	1
EPA-Fc		"	"	1	1
EPA-Fd		"	"	1	1
EPA-Fe		"	"	1	1
EPA-Ga		Day 16	"	1	1

TABLE 4-3
Analyses Requested for Groundwater Samples – Existing Wells and New MP Wells
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**VOCs**	**Perchlorate**
Analysis Method				EPA SOW SOM01.X	EPA Method 314
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days
Number of Containers				3 x 40 mL glass vials	1 x 125 mL poly bottle
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**	
EPA-Gb		"	"	1	1
EPA-Gc		"	"	1	1
EPA-Gd		"	"	1	1
EPA-Ge		"	"	1	1
Blank	Equip.	Day 1	"	1	1
Blank	Equip.	Day 2.	"	1	1
Blank	Equip.	Day 3	"	1	1
Blank	Equip.	Day 4	"	1	1
Blank	Equip.	Day 5	"	1	1
Blank	Equip.	Day 6	"	1	1
Blank	Equip.	Day 7	"	1	1
Blank	Equip.	Day 8	"	1	1
Blank	Field.	Day 9	"	1	1
Blank	Equip.	Day 10	"	1	1
Blank	Equip.	Day 11	"	1	1
Blank	Equip.	Day 12	"	1	1
Blank	Equip.	Day 13	"	1	1
Blank	Equip.	Day 14	"	1	1
Blank	Equip.	Day 15	"	1	1
Blank	Equip.	Day 16	"	1	1
TOTAL SAMPLES				**102**	**102**

Notes:
Lab QC samples will be three times the normal sample volume.
Dup. = Duplicate sample collected.

4.2 Soil

Table 4-4 presents information required in the field regarding the specific analyses requested, preservatives, container requirements, and holding times for the soil samples collected during the field investigation. Appendix A presents the draft Regional Sample Control Center Form provided for planning purposes.

The soil boring sampling event is tentatively scheduled to occur in 1st Quarter 2009. Sampling dates are dependent upon permission for site access and approval of the planning documents.

TABLE 4-4
Analyses Requested for Soil Samples
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**Perchlorate**
Analysis Method				EPA Method 314
Preservatives				Cool to 4°C
Analytical Holding Time				<28 Days
Number of Containers				4 oz. jar
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**
EPASB-01-10	Lab QC	Day 1	Low	1
EPASB-01-20	Dup.	"	"	2
EPASB-01-30		"	"	1
EPASB-01-40		"	"	1
EPASB-01-50		"	"	1
EPASB-01-60		"	"	1
EPASB-01-70		Day 2	"	1
EPASB-01-80		"	"	1
EPASB-01-90		"	"	1
EPASB-01-100		"	"	1
EPASB-02-10		"	"	1
EPASB-02-20		"	"	1
EPASB-02-30		Day 3	"	1
EPASB-02-40		"	"	1
EPASB-02-50		"	"	1
EPASB-02-60		"	"	1
EPASB-02-70	Dup.	"	"	2

TABLE 4-4
Analyses Requested for Soil Samples
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**Perchlorate**
Analysis Method				EPA Method 314
Preservatives				Cool to 4°C
Analytical Holding Time				<28 Days
Number of Containers				4 oz. jar
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**
EPASB-02-80		"	"	1
EPASB-02-90		Day 4	"	1
EPASB-02-100		"	"	1
EPASB-03-10	Lab QC	"	"	1
EPASB-03-20		"	"	1
EPASB-03-30		"	"	1
EPASB-03-40		"	"	1
EPASB-03-50	Dup.	Day 5	"	2
EPASB-03-60		"	"	1
EPASB-03-70		"	"	1
EPASB-03-80		"	"	1
EPASB-03-90		"	"	1
EPASB-03-100		"	"	1
Blank	Equip.	Day 1	"	1
Blank	Equip.	Day 2	"	1
Blank	Equip.	Day 3	"	1
Blank	Equip.	Day 4	"	1
Blank	Equip.	Day 5	"	1
TOTAL SAMPLES				**38**

Notes:
Lab QC samples will be three times the normal sample volume.
Dup. = Duplicate sample collected.

4.3 Soil Gas

Table 4-5 presents information required in the field regarding the specific analyses requested, preservatives, container requirements, and holding times for samples collected for soil gas. Appendix A presents the draft Regional Sample Control Center Form provided for planning purposes.

The initial soil gas sampling event is tentatively scheduled to occur in 1st Quarter 2009, at the conclusion of the soil boring sampling event. Sampling dates are dependent upon permission for site access and approval of the planning documents. After the initial sampling event, the soil gas probes will be monitored for an additional 2 quarterly events.

TABLE 4-5
Analyses Requested for Soil Gas Samples
B.F. Goodrich Site RI/FS

Specific Analyses Requested				**VOCs**
Analysis Method				TO-15
Preservatives				None
Analytical Holding Time				< 14 Days
Number of Containers				1 Summa Canister
Sample Locations	**Sample Type**	**Sched.**	**Conc.**	**Number of Samples**
EPASV-01-25		Day 1	Low	1
EPASV-01-50	Dup.	"	"	2
EPASV-01-75		"	"	1
EPASV-01-100		"	"	1
EPASV-02-25		"	"	1
EPASV-02-50		"	"	1
EPASV-02-75		Day 2	"	1
EPASV-02-100		"	"	1
EPASV-03-25		"	"	1
EPASV-03-50		"	"	1
EPASV-03-75		"	"	1
EPASV-03-100		"	"	1
TOTAL SAMPLES				**13**

Notes:
Dup. = Duplicate sample collected.

4.4 Investigation-Derived Wastes

This section presents the requests for analyses (RFAs) for IDW samples that will occur during the field investigation. IDW for this field investigation includes well drilling cuttings and fluids, as well as well development water and groundwater monitoring purge water. IDW will be analyzed for VOCs, Perchlorate, Metals, pH, Flashpoint, and Total Petroleum Hydrocarbons (TPH) for gasoline, diesel, and motor oil. For each new MP well, it is estimated that 5 roll-off bins and 2 water tanks will be required for construction and development.

Table 4-4, IDW Request for Analysis, presents information required in the field regarding the specific analyses requested, preservatives, container requirements, and holding times for samples collected. Appendix A presents the draft Regional Sample Control Center Form provided for planning purposes.

The IDW sampling will occur near the completion dates for each of the Multi-Port well installations, scheduled from early to mid 2009.

TABLE 4-6
Analyses Requested for IDW Samples
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate	TPH Gasoline	TPH Diesel	TPH Motor Oil	TTLC Metals	pH	Flashpoint
Analysis Method				EPA SOW SOM01.X	EPA Method 314	EPA 8015m	EPA 8015m	EPA 8015m	EPA 6010/7471 (SOPs 405, 503, and 517)	EPA 9045 (SOP 582)	EPA 1010
Preservatives				HCl to pH <2; chill to 4℃; no headspace	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days	<48 hours	<14 days	<14 days	<6 months	<7 days	<14 days
Number of Containers (solids)				3 x Encore containers	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar
Number of Containers (liquids)				3 x 40 mL glass vials	1 x 125 mL poly bottle	2 x 40 mL glass vials	1 x 500 mL glass bottle	1 x 500 mL glass bottle	1 x 250 mL poly bottle	1 x 250 mL poly bottle	1 x 250 mL poly bottle
Sample Locations	**Storage Container**	**TAT**	**Conc.**	**Number of Samples**							
EPA-A-Bin1	Roll-Off Bins-Composite	7 days	Low	1	1	1	1	1	1	1	1
EPA-A-Bin2	"	"	"	1	1	1	1	1	1	1	1
EPA-A-Tank1	Tank	"	"	1	1	1	1	1	1	1	1
EPA-A-Tank2	"	"	"	1	1	1	1	1	1	1	1
EPA-B-Bin1	Roll-Off Bins-Composite	"	"	1	1	1	1	1	1	1	1
EPA-B-Bin2	"	"	"	1	1	1	1	1	1	1	1
EPA-B-Tank1	Tank	"	"	1	1	1	1	1	1	1	1
EPA-B-Tank2	Tank	"	"	1	1	1	1	1	1	1	1
EPA-C-Bin1	Roll-Off Bins-Composite	"	"	1	1	1	1	1	1	1	1
EPA-C-Bin2	"	"	"	1	1	1	1	1	1	1	1
EPA-C-Tank1	Tank	"	"	1	1	1	1	1	1	1	1
EPA-C-Tank2	Tank	"	"	1	1	1	1	1	1	1	1

TABLE 4-6
Analyses Requested for IDW Samples
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate	TPH Gasoline	TPH Diesel	TPH Motor Oil	TTLC Metals	pH	Flashpoint
Analysis Method				EPA SOW SOM01.X	EPA Method 314	EPA 8015m	EPA 8015m	EPA 8015m	EPA 6010/7471 (SOPs 405, 503, and 517)	EPA 9045 (SOP 582)	EPA 1010
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days	<48 hours	<14 days	<14 days	<6 months	<7 days	<14 days
Number of Containers (solids)				3 x Encore containers	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar
Number of Containers (liquids)				3 x 40 mL glass vials	1 x 125 mL poly bottle	2 x 40 mL glass vials	1 x 500 mL glass bottle	1 x 500 mL glass bottle	1 x 250 mL poly bottle	1 x 250 mL poly bottle	1 x 250 mL poly bottle
EPA-D-Bin1	Roll-Off Bins-Composite	“	“	1	1	1	1	1	1	1	1
EPA-D-Bin2	“	“	“	1	1	1	1	1	1	1	1
EPA-D-Tank1	Tank	“	“	1	1	1	1	1	1	1	1
EPA-D-Tank2	Tank	“	“	1	1	1	1	1	1	1	1
EPA-E-Bin1	Roll-Off Bins-Composite	“	“	1	1	1	1	1	1	1	1
EPA-E-Bin2	“	“	“	1	1	1	1	1	1	1	1
EPA-E-Tank1	Tank	“	“	1	1	1	1	1	1	1	1
EPA-E-Tank2	Tank	“	“	1	1	1	1	1	1	1	1
EPA-F-Bin1	Roll-Off Bins-Composite	“	“	1	1	1	1	1	1	1	1
EPA-F-Bin2	“	“	“	1	1	1	1	1	1	1	1
EPA-F-Tank1	Tank	“	“	1	1	1	1	1	1	1	1
EPA-F-Tank2	Tank	“	“	1	1	1	1	1	1	1	1
EPA-G-Bin1	Roll-Off Bins-	“	“	1	1	1	1	1	1	1	1

TABLE 4-6
Analyses Requested for IDW Samples
B.F. Goodrich Site RI/FS

Specific Analyses Requested				VOCs	Perchlorate	TPH Gasoline	TPH Diesel	TPH Motor Oil	TTLC Metals	pH	Flashpoint
Analysis Method				EPA SOW SOM01.X	EPA Method 314	EPA 8015m	EPA 8015m	EPA 8015m	EPA 6010/7471 (SOPs 405, 503, and 517)	EPA 9045 (SOP 582)	EPA 1010
Preservatives				HCl to pH <2; chill to 4°C; no headspace	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C	Cool to 4°C
Analytical Holding Time				< 14 Days	<28 Days	<48 hours	<14 days	<14 days	<6 months	<7 days	<14 days
Number of Containers (solids)				3 x Encore containers	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar	4 oz. jar
Number of Containers (liquids)				3 x 40 mL glass vials	1 x 125 mL poly bottle	2 x 40 mL glass vials	1 x 500 mL glass bottle	1 x 500 mL glass bottle	1 x 250 mL poly bottle	1 x 250 mL poly bottle	1 x 250 mL poly bottle
	Composite										
EPA-G-Bin2	"	"	"	1	1	1	1	1	1	1	1
EPA-G-Tank1	Tank	"	"	1	1	1	1	1	1	1	1
EPA-G-Tank2	Tank	"	"	1	1	1	1	1	1	1	1
EPA-SB1-Bin 1	Roll-Off Bin	"	"	1	1	1	1	1	1	1	1
EPA-SB1-Bin 2	Roll-Off Bin	"	"	1	1	1	1	1	1	1	1
EPA-SB2-Bin 1	Roll-Off Bin	"	"	1	1	1	1	1	1	1	1
EPA-SB2-Bin 2	Roll-Off Bin	"	"	1	1	1	1	1	1	1	1
EPA-SB3-Bin 1	Roll-Off Bin	"	"	1	1	1	1	1	1	1	1
EPA-SB3-Bin 2	Roll-Off Bin	"	"	1	1	1	1	1	1	1	1
Existing Well-Purge Water	Tank (3 events)	"	"	3	3	3	3	3	3	3	3
TOTAL SAMPLES				37	37	37	37	37	37	37	37

Notes:
Lab QC samples will be three times the normal sample volume.
Dup. = Duplicate sample collected.
TAT = Turn Around Time

SECTION 5

Field Methods and Procedures

This section of the FSP provides information on field activities associated with the B.F. Goodrich Site RI field investigation. Included in this section are methods and procedures for the following:

- Multi-Port (MP) monitoring well drilling and construction
- Soil Boring Drilling and Soil Vapor Probe Construction
- Groundwater Sample Collection
- Soil Sample Collection
- Soil Gas Sample Collection
- Sample Containers and Preservation
- Decontamination
- Sample management procedures and documentation
- Disposal of investigation-derived wastes
- Quality control samples

5.1 Multi-Port Monitoring Well Drilling and Construction

5.1.1 Drilling

All boreholes for MP wells will be advanced using the direct mud rotary drilling technique. Drilling mud will be used to minimize borehole collapse and to assist in evacuating drill cuttings from the boreholes. Drilling mud is expected to reduce the possibility of cross contamination between groundwater zones because it continuously invades the formation along the borehole walls and forms a low-permeability mud cake.

Drilling mud will consist of bentonite and water. No other additives will be permitted in the mud unless approved by the site hydrogeologist and EPA remedial project manager (RPM). The viscosity and density of the drilling mud will be tested periodically and maintained within the limits specified by the site hydrogeologist or engineer. Drilling mud will be forced down the drill pipe and out through ports in the drill bit utilizing the lowest viscosity mud capable of evacuating drill cuttings from the borehole.

Well design (e.g., location of screen intervals and sampling points) is based largely on the results of geophysical logging, and to a much lesser extent on the lithologic log generated from cuttings collection. Thus it is imperative to be able to run geophysical logs in the borehole. Geophysical logs can be run by removing the drive casing and backfilling the borehole with bentonite drilling mud.

Although not quantifiable, we expect that the amount of groundwater that might enter the borehole in one location and exit in another location during mud rotary drilling is negligible, especially when compared to the large quantities of water typically removed from the various screen intervals during well development . Use of bentonite drilling mud is designed to minimize water loss or gain in the borehole during drilling and well construction. Use of the drilling mud results in a thin layer of mud forming on the borehole wall and penetrating into the formation. It is this layer that minimizes water loss/gain, allowing the borehole to stay open during drilling, thus allowing placement of well casing and screen. All fluids and drill cuttings produced during the drilling operation will be contained and disposed of as indicated in Section 5.9.

Dig Alert, a utility notification service, will be contacted at least 72 hours prior to initiation of drilling. Dig Alert will notify the appropriate utility companies to identify and mark any underground utility lines in the drilling zone. A geophysical survey may be conducted at each boring location to clear the area for any subsurface utilities. In addition, the upper 5 feet of each boring will be hand-augered to avoid accidental damage to any subsurface utilities not previously identified.

5.1.2 Borehole Drill Cuttings Collection

Borehole drill cuttings will be collected for lithologic logging over 10-foot intervals as drilling fluids are circulated through the borehole. The drill cuttings will be logged onsite by a hydrogeologist. Downhole soil samples will not be collected for laboratory analysis.

Samples will be collected and the lithology logged. Following completion of the boring, cutting samples will be disposed of with the rest of the drill cuttings.

5.1.3 Well Installation and Construction

MP monitoring well and screen interval depths will be selected by the site hydrogeologist (in consultation with the CH2M HILL project manager and EPA RPM) based primarily on the review of lithologic and geophysical logs for the borehole and on comparison to screen intervals of nearby wells with known contamination. The lithologic and geophysical logs for the borehole will assist the hydrogeologist in selecting stratigraphic units with higher permeability (i.e., sand, gravel, or both), because they would be expected to provide preferential pathways for contamination. By comparing these units with screen intervals of existing wells with known contamination, the hydrogeologist will be able to select screen intervals that are most likely to span areas of contaminant migration.

Immediately upon completion of the drilling, boreholes will be geophysically logged. Results from the geophysical logging will help determine which zones to monitor. The following geophysical logs will be run:

- Resistivity (16- and 64-inch lateral)
- Spontaneous potential (SP)
- Focused resistivity
- Natural gamma
- Sonic
- Caliper

The geophysical logs and lithologic logs will be reviewed and the desired monitoring zones identified and delineated. Groundwater monitoring wells will then be designed for the boreholes (e.g., well depth and screened interval[s]). The site hydrogeologist will produce a field sketch of the well design. Monitoring well designs for the MP wells are discussed below.

5.1.3.1 Typical Multiport Monitoring Well Design

MP monitoring wells are a series of nested monitoring points installed on a customized casing string with multiple-screened intervals within a single, cased borehole. This system casing (see Figure 5-1) includes specialized couplings, casings, permanently installed packers, pumping ports, and special pressure measurement and sampling ports.

The seven MP wells will be installed in 12-inch-diameter borings. The outer well casing will consist of alternating sections of 4-inch-inside-diameter (ID) Schedule 10S stainless-steel (Type 304) and Schedule 40 mild steel casing (Figure 5-1). Stainless-steel or mild steel centralizers will be attached to the well casing approximately every 50 feet during installation. Stainless-steel centralizers will be attached to stainless-steel casing and mild steel centralizers will be attached to mild steel casing.

Gravel pack will be tremmied around each screened interval, generally extending 10 feet above and below a screen, as shown in Figure 5-1. Gravel pack material will consist of thoroughly washed, hard, durable, siliceous sand.

The size and gradation of the gravel pack, as well as the screen slot size, will be assessed by the site hydrogeologist on the basis of field examination of formation samples and on the construction specifications of existing MP wells in the Rialto-Colton Basin. A minimum of 3 feet of fine silica sand will be placed directly above and below the gravel pack material to separate it from the bentonite/sand seals. Annular seals between the screened zones, consisting of a 50:50 mixture (dry volume) of bentonite chips and sand, will be placed between each screen zone in the MP wells. The two constituents will be mixed dry, then mixed with clean water and injected at specific depths using a tremmie pipe. The uppermost annular seal in each well will consist of cement grout, with a small amount of bentonite powder to reduce grout shrinking and cracking.

After completion of well construction, each screened interval will be developed by a combination of bailing, swabbing, and pumping. The drilling subcontractor will install temporary packers each night during well development, prior to installation of the Westbay packer system. This will significantly decrease the potential for cross contamination during well development. Initial well development will consist of bailing residual mud from the well, followed by airlifting and swabbing with a surge block. Following airlifting and swabbing, a submersible pump with straddle packers will be placed in the well to develop each screened interval separately. The pump will be turned on and off periodically to induce backwashing of the water into the gravel pack and aquifer. A turbidity meter will be used to monitor turbidity levels in water during well development. Development will continue until a value of not greater than 5 nephelometric turbidity units (NTU) is achieved or until the water is relatively clear and sediment free and the onsite hydrogeologist deems that further development would be ineffective. Development of existing MP well screens within the Rialto-Colton Basin has been successful using methods described in this FSP.

Upon completion of the development activities, a video survey of the well casing and screen of each MP well will be conducted. The MP system instrumentation will be installed after confirmation of the well casing and screen assembly integrity through the video survey.

The system consists of casing, couplings with sampling and pumping ports, and inflatable packers. The bottom packer for each zone will be set within the blank stainless-steel casing. The upper packer, and a companion packer, will be set within a single length of blank mild steel casing immediately above the blank stainless-steel casing of each zone. These two packers will serve to isolate a measurement port (see below) for testing the integrity of the packers between screened intervals. Typical construction details (Figure 5-1) are discussed as follows:

- MP casing, couplings, and packer locations will be dictated by the screened interval depths.
- The MP casing serves as blank casing along the interior of the outer 4-inch-diameter well casing.
- The function of the special MP measurement port coupling is to allow for fluid pressure measurement and for water sample collection. A measurement port is also installed between perforated intervals to test the integrity of the inflatable packers. The MP pumping port coupling allows for a one-time purging of the zone to be sampled (if deemed necessary, additional purging can be done through the pumping ports in the future).
- The inflatable packers provide a seal between screened intervals along the interior of the well casing, thereby precluding cross contamination and vertical movement of fluids within the well. Each perforated interval is separated by three packers.
- Within each screened monitoring zone, the instrumentation consists of a pumping and a monitoring port coupling.
- The packers will be installed at a maximum of 5 feet below each screened interval and 15 and 25 feet above each screened interval.
- The sampling port coupling will be installed adjacent to the pumping port coupling with 1 to 3 feet of blank MP casing separating the couplings. All ports will be closed so that no water can enter the center of the MP system.
- Both the pumping and monitoring couplings will be located adjacent to the screened interval (i.e., within the 10-foot depth interval of the screen).

It should be noted that the greatest risk of cross contamination exists after well development and before installation of the MP instrumentation. This potential for cross contamination will exist for approximately 24 hours (the time required to install and inflate the hydraulic packers the day after well development is completed). To minimize the potential for cross contamination, all efforts will be made to provide the MP instrumentation onsite prior to completion of well development. This will allow the MP instrumentation to be installed immediately after well development. If the MP instrumentation is not onsite upon the completion of well development, the temporary packers used during well development will be installed in the well until the MP instrumentation is ready for installation.

After the MP instrumentation has been installed, one pumping port at a time will be opened and that interval pumped at the maximum available pumping rate (approximately 1 gallon per minute [gpm]). Pumping will continue for approximately 2 hours (or until the discharge is clear, as determined by the site hydrogeologist).

The wellhead completion detail shown in Figure 5-2 will be used for MP monitoring wells. Following completion of the wellheads, each MP monitoring well will be surveyed to determine the well location and elevation. Survey results will be entered into EPA's Rialto-Colton database.

5.2 Soil Boring Drilling and Soil Vapor Probe Construction

5.2.1 Drilling

The three soil borings (EPASB-01, EPASB-02, and EPASB-03) are to be installed at the location of the historic burn pits that were active in the 1960s as part of B.F. Goodrich's operations in the 160-Acre Area. All three borings are expected to be located inside a large concrete curing building on Rialto Concrete Products property. In the center of the building, the roof is approximately 25 feet high. Near the walls, the ceiling height is 20 feet. The portion of the building targeted for drilling are currently almost empty and have large access doors. A hollow-stem auger rig has successfully drilled within this building in the past; however, the total depth was shallower than is currently proposed. The subsurface lithology is a sandy/gravelly formation with larger cobbles. The goal is to obtain continuous cores so it may be possible to target collection of soil samples from depth intervals with a higher percentage of finer-grained intervals. The presence of finer-grained soils is likely limited in the upper 100 feet. The depth to water is over 400 feet below ground in this area.

The borings will be advanced using the sonic drilling technique. The sonic drilling method provides continuous (disturbed) samples in a wide range of soil types, including soils with large particles that preclude sampling by many other techniques. The drill stem and sampler barrel are vibrated vertically at frequencies between about 50 and 180 Hz such that the sampler barrel normally advances by slicing through the soil. If the sonic drilling method is not successful, an alternate drilling method using an air- rotary casing hammer (ARCH) drill rig may be used.

Dig Alert, a utility notification service, will be contacted at least 72 hours prior to initiation of drilling. Dig Alert will notify the appropriate utility companies to identify and mark any underground utility lines in the drilling zone. A geophysical survey may be conducted at each boring location to clear the area for any subsurface utilities. In addition, the upper 5 feet of each boring will be hand-augered to avoid accidental damage to any subsurface utilities not previously identified.

5.2.2 Soil Vapor Probe Construction

The lithologic logs prepared from logging the continuous cores will be reviewed and the desired soil vapor probe depths will be identified. It is anticipated that 4 monitoring probes will be installed in each boring, with target depths of 25, 50, 75 and 100 feet below ground surface.

The soil vapor probes will be composed of ¼-inch diameter polyethylene tubing that is perforated at the downhole end of the probe. The probes are set down the borehole at the designated depths. The probe tip is placed midway between the top and bottom of the sampling interval within a sand pack extending 6 inches above and below the sampling interval. Because multiple (up to five) sampling points are installed within a single borehole, the borehole will be grouted between sampling points. One foot of dry granular bentonite will be placed between the filter pack and the grout at each sampling location within the borehole. At least 1 foot of dry granular bentonite will be placed on top of the sand pack to preclude the infiltration of hydrated bentonite grout into the sand pack. Tubing must be properly marked at the surface to identify the probe location and depth. Figure 5-3 is a schematic of a typical 5-zone soil vapor probe.

The surface completion of each soil gas probe will be a concrete encased well casing box with a flush mount 8-inch well cover.

5.3 Groundwater Sample Collection

Groundwater samples from the new MP wells, selected existing monitoring (conventional and multiport) and production wells will be collected during the field investigation. The following subsections describe groundwater sample collection procedures .

5.3.1 Multi-Port Monitoring Wells

The procedures for sampling MP wells differ from those for conventional monitoring wells. MP wells do not have standing water inside the well casing; thus purging the well prior to sampling is not required. Groundwater samples are taken directly from the formation via the depth-discrete sampling ports and a specially-designed sampling tool. Numerous QC procedures are used during sampling, and sampling is performed by a Westbay-certified sampler. The sampling tool is lowered to the desired sampling port and activated from the surface to seat against and open the port. After the attached sampling vessel is filled, the port is closed and the tool is brought to the surface. A sampling tool with up to four 250-milliliter (mL), stainless-steel cylinders will be used for sampling MP wells. Once the full sampling tool is at the surface, the sample is transferred directly into the appropriate sample containers for transport to the laboratory.

The first sample drawn from each depth will be used to measure field parameters (temperature, pH, turbidity, and electrical conductivity [EC]) and to allow for some flushing of the sampling instrumentation. All measurements will be recorded in a field logbook along with the date, time, and location of each measurement. The second sample drawn from each depth will be collected for VOC, then perchlorate analysis. Groundwater will first be transferred to the volatile organic analysis (VOA) sample bottles by means of a small-aperture valve located on the end of the 250-mL stainless steel cylinder, permitting a small stream of groundwater to exit the cylinder. In this manner, the flow rate into the sample bottles is controlled, so that sampling becomes analogous to low-flow micro-purge groundwater sampling. After all of the VOA vials are filled with no headspace, the sample containers for perchlorate will be filled. The sampling procedure will be repeated until sufficient water is obtained from each port and all sampling ports are sampled. Disposable gloves will be used during sampling, and a new pair of gloves will be used at each port.

5.3.2 Conventional Monitoring Wells

Groundwater samples for water-quality analyses will be collected from monitoring wells with and without dedicated pumps. Each well will be pumped until field parameters (temperature, pH, turbidity, and conductivity) have stabilized (i.e., +/- 1 degree in temperature, +/- 0.1 pH units, +/- 3% conductivity, and +/- 10% turbidity) over three successive readings and a minimum of three casing volumes have been removed from the well prior to collecting samples. A casing volume is calculated by multiplying the head of water in the casing (well depth minus depth-to-water) by the cross-sectional area of the casing (πr^2). Casing volume determination will be based on measurements of the depth-to-water at the time of sampling. An electric sounder will be used to take water level measurements. The volume of water pumped also will be recorded when measuring field parameters. If any of the parameter readings fall outside of the calibration limits of the field instruments, the instruments will be recalibrated to a range that encompasses the observed values.

Because of the large depth-to-water at the wells to be sampled (over 400 feet), flow rates for the pumps used to purge the wells may not be able to be set low enough (100 milliliters per minute [mL/min]) to ensure representative samples. If this is the case, as disposable double check-valve bailer will be used to the collect the sample following purging and parameter stabilization. However, near the completion of purging, an attempt will be made to adjust the flow rate to approximately 100 mL/min. If flow rates can be adjusted low enough, sample containers will be filled using disposable, non-reactive tubing (such as Teflon®) that conveys water from the sampling valve into the appropriate sample container. Disposable gloves will be worn during sampling, and a new pair of gloves will be used at each well.

A mobile submersible pump will be used for purging monitoring wells that are not equipped with a dedicated pump, following the above-outlined guidelines. The pump will be placed in the center of the well screen. Use of a non-dedicated pump will require thorough decontamination between wells; a process described in Section 5.7.

5.3.3 Low-Flow Groundwater Sampling

Low-flow groundwater sampling is the process of purging and sampling wells at low flow rates from within the well screen zone to minimize purging and improve sample quality. Low-flow groundwater sampling has the advantage of producing a representative groundwater sample with less total well purge water than is obtained from conventional sampling of monitoring wells, in which three well volumes are purged prior to sampling.

Low-flow purging and sampling refers to the velocity with which water enters the pump intake, not necessarily to the flow rate of water discharged at the surface. Water-level drawdown provides the best indication of the stress imparted by a given flow rate for a given hydrological situation.

If possible, low-flow groundwater sampling will be conducted at monitoring wells that do not have permanent pumps. The ability to conduct low-flow sampling may be hindered by the large depth-to-water (typically over 400 feet at the conventional monitoring wells). A 2-inch diameter submersible pump with variable flow-rate control, as low as the 100-mL/min rate recommended by EPA, will be placed in the middle of the screened interval. The proper flow rate for each well will be based on the ability to establish a low-flow rate at an acceptable level of drawdown (0.2 to 0.3 foot), and with minimum fluctuations of the water level during pumping. To achieve this, the pump initially will be operated at the minimum flow capacity of the pump, and then the flow rate will be increased gradually until some initial drawdown is observed. The flow rate then will be reduced slightly to achieve a stabilized purge rate for the well. It is anticipated that flow rates on the order of 0.1 to 0.5 liter per minute (L/min) will be achieved. However, the flow rate will not exceed 1.0 L/min in any case.

Careful, continuous measurement of field parameters including turbidity, temperature, EC, and pH will be used to assess when purged water has reached equilibrium. The time interval between readings will be dictated by the stabilized pumping rate for each well (typically between 1 and 3 minutes). An initial change in the measurements typically indicates that water is being drawn from a different source ("active" versus "stagnant" water). Stabilization of these parameters would indicate that the water is coming from a steady-state source (the formation immediately surrounding the well screen near the pump intake). Equilibrium conditions are sometimes achieved after extraction of less than 10 liters, with 4 to 8 liters being the average reported in published studies. Therefore, the volume of water removed by this method during purging will be less than with conventional purging techniques.

Accurate measurement of the field parameters will require a flow-through cell or other means to ensure that the purge water is monitored continuously. Although the flow-through cell is the preferred method, an acceptable alternate method is placing the probes in a small bucket or beaker that continuously overflows with the discharge tubing placed near the probes, and covering the beaker or bucket with clear plastic film (such as Saran Wrap®).

5.3.4 Field Parameter Measurement

A Horiba U-10, or equivalent, will be used for field measurements of pH, EC, and temperature. Turbidity measurements will be made with a HACH 2100p turbidimeter. Samples for field measurements will be collected in a beaker used solely for field parameter determinations. All probes will be thoroughly rinsed with distilled water prior to and between any measurements at each well.

Equipment used to measure field parameters will be maintained and calibrated according to manufacturer specifications. Calibration will occur at the start and midway through each day and recorded in the field logbook along with equipment serial number. As noted above, if field parameter readings fall outside of the range of values used in calibration, the instruments will be recalibrated to a range that encompasses the observed values.

5.4 Soil Sample Collection

Soil samples will be collected at approximately 10-foot intervals from each of the soil borings. The sonic drilling method will produce a continuous soil core of the borehole. Based on a visual assessment of the continuous core, the location within each 10-foot depth-interval that contains the highest percentage of finer-grained materials (including fine-grained sands) will be targeted for sample collection. Once the core has been lithologically logged, soil from the designated depth will be placed into the appropriate sample jars.

5.5 Soil Gas Sample Collection

Soil gas samples will be collected in 6-liter SUMMA™ canisters, certified clean to VOC method TO-15 reporting limits. A SUMMA™ canister has a soil gas purge train and a sample train (Figure 5-4). The soil gas purge train consists of a water and dust trap, a vacuum gauge connected by copper tubing and a syringe to draw samples. The sample train consists of a flow regulator, compression or Swagelok® fittings, a vacuum gauge, and a 6-liter SUMMA™ canister. To ensure that stagnant or ambient air is removed from the sampling system and the samples collected are representative of subsurface conditions, three system volumes will be purged prior to collecting samples. The vacuum purge rate will be between 100 to 200 milliliters per minute (mL/min). The purge rate may be modified in the field due to lithologic conditions.

After the purging is complete, a stainless steel three-way switching valve will be turned to allow flow to be diverted to the SUMMA™ canister. A twist valve on the canister will be opened, and the vacuum in the canister will be recorded prior to sampling along with beginning sample time. When the vacuum gauge reaches *near* zero, the twist valve will be closed, and the time will be recorded. The sample container will not be allowed to fill completely to ambient pressure (i.e., to 0.0 inches of water on the pressure gauge) and some residual vacuum will be left in the canister. After the sample has been collected, the brass plug will be placed and tightened over the swage fitting. The final canister pressure will be recorded on the chain-of-custody (COC) form.

When sampling is conducted at each nested soil vapor probe location, a leak check will be performed at locations where ambient air can enter the sampling system or where cross-contamination may occur. A leak detection compound, isopropyl alcohol (IPA), will be used for the leak check. A clean towel dampened with IPA will be placed around the base of the probes at the ground surface. IPA will be added to the list of compounds to be analyzed by EPA Method TO-15.

5.6 Sample Containers and Preservation

5.6.1 Groundwater Sampling

Sample container requirements and preservation methods for each analysis are summarized in Tables 4-1 (groundwater) and 4-2 (soil). Sample containers will be laboratory-provided or purchased with certificates of cleanliness from approved laboratory product suppliers.

Samples to be analyzed for VOCs will be collected in three 40-mL glass VOA vials. A sufficient amount of 1:1 hydrochloric acid (HCl) will be placed inside the vials to lower the sample pH to less than 2.

Samples will be periodically tested to ensure sufficient preservatives have been added (e.g., a test bottle or vial); and the test bottles will be filled and checked to determine if sufficient preservatives have been added using the following (or similar) steps to:

- Add preservative to test sample vial.
- Fill with sample, cap, and invert to ensure mixing.

- Test pH to determine if less than 2 is achieved. If so, add same amount of preservative to actual sample vial and collect sample. Discard test vial.
- If not, pour out contents from test vial.
- Refill vial, add an increased amount of preservative, and repeat until pH of less than 2 is achieved.

The vials will be filled so that no head space is present after sample collection. Filled containers will be checked by inverting the vial and tapping to reveal any air bubbles. If air bubbles are present, containers will be emptied, re-acidified, and refilled. If after several attempts at sample collection, air bubbles remain, the sample will be described in the field logbook as an "aerated sample." VOA vials will be cooled to 4 degrees Celsius (°C) and stored away from sunlight prior to shipping.

Sampling for perchlorate analysis will consist of one 125-mL polyethylene bottle that will be cooled to 4°C after sample collection.

5.6.2 Soil Sampling

Soil from the selected borehole depths will be placed into 8-ounce glass sample jars, labeled and cooled to 4°C after sample collection.

5.6.3 Soil Gas Sampling

Soil gas samples will be collected in 6-liter SUMMA™ canisters, certified clean to VOC method TO-15 reporting limits. The canisters will be properly labeled and transported by courier to a certified laboratory for analysis.

5.6.4 Investigation-Derived Wastes

Drill cuttings samples in roll-off bins will be collected using an Encore or equivalent sampling apparatus and container. The Encore (or equivalent) sampling apparatus will be provided by the laboratory, as will the hermetically sealed 25-gram sample containers. The sample container will be pushed into the cuttings approximately 6 inches below the previously exposed surface of the material in the roll-off bin. The exterior of the container will then be wiped with a clean towel to remove any solids and permit closure of the container. The container will be closed according to the manufacturer's instructions. Sample ID information will be filled out on the back of the reclosable (originally hermetically sealed) sample pouch, as well on a removable sample tag. The maximum analytical holding time for VOCs will be 14 days. Drill cuttings samples for additional analyses will be collected in 4 ounce glass jars.

One drilling fluid sample per "Baker" tank at each well site will be collected and submitted for laboratory analysis. Each sample will be collected using a new, disposable polyethylene bailer and inert rope to fill the appropriate sample containers. After collecting drilling fluid from near the bottom of the temporary storage container, the liquid will be slowly poured from the bailer into the sample container to minimize agitation and to prevent overfilling of the container. High liquid-content drilling mud holding times are identical to drill cutting and low liquid-content holding times, except that the samples will be collected in two 1-liter amber glass bottles and cooled to 4°C.

Monitoring well development water from each well will be stored onsite in temporary storage containers pending results from sampling. Each well development water sample will be collected using a new, disposable polyethylene bailer and inert rope to fill the appropriate sample containers (e.g., acidified, 40-mL glass vials for VOC analysis). After collecting water from mid-depth in the temporary storage container, the water will be slowly poured from the bailer into the sample containers to minimize agitation and to prevent overfilling of the containers.

Purge water from sampling conventional monitoring wells will be placed in storage tanks at a designated staging area. The tanks will be sampled in the same way as the well development water.

5.7 Decontamination

The groundwater sampling and soil sampling equipment, including the MP well sampling tools, 250-mL stainless-steel cylinders, sieves used for soil samples, and any tool used to transfer soil from the core into the sieve will be decontaminated by the following procedure:

- Wash with non-phosphate detergent
- Rinse with deionized water
- Rinse with high-performance liquid chromatography (HPLC)-grade water
- Air dry

When a mobile submersible pump is used to sample wells without dedicated pumps, the following procedure will be used to decontaminate the pump and any discharge tubing that will be re-used between wells:

- Submerge the pump and full length of discharge tubing in a non-phosphate detergent bath.
- Operate the pump, while submerged, to circulate detergent through the pump mechanism and discharge tubing. The pump will be operated long enough to allow a minimum of five tubing volumes to pass through the pump and discharge tubing.
- Remove the pump and tubing from the detergent bath and pump any remaining detergent back into the detergent bath or to waste. Submerge the pump and the full length of discharge tubing in a potable water bath.
- Operate the pump, while submerged, to circulate potable water through the pump mechanism and discharge tubing, and flush out remaining detergent. The pump will be operated long enough to allow a minimum of five tubing volumes to pass through the pump and discharge tubing.
- Remove the pump and tubing from the potable water bath and pump any remaining rinse water into the potable water bath or to waste. Submerge the pump and the full length of discharge tubing in a deionized water bath.
- Operate the pump, while submerged, to circulate deionized water through the pump mechanism and discharge tubing, and flush out remaining potable water. The pump

will be operated long enough to allow a minimum of five tubing volumes to pass through the pump and discharge tubing.

- Remove the pump and tubing from the deionized water bath and pump any remaining deionized water into the deionized water bath.

The detergent, potable water, and deionized water baths will be emptied as IDW water and replenished between each well. If possible, wells will be sampled in an order progressing from least contamination to highest contamination, to prevent cross-contamination of wells with minimal or undetectable VOC concentrations. As an alternative to the above decontamination procedure, new disposable discharge tubing might be used at each well, with the pump mechanism decontaminated by submersion and pumping in detergent, potable water, and deionized water baths, consecutively.

For the three soil borings on the 160-Acre Area, all downhole drilling equipment will be pressure washed between borehole locations.

5.8 Sample Management Procedures and Documentation

The following section discusses various sample management procedures that will be implemented during field activities. Included in these sections are procedures for sample packaging and transportation, sample labeling, and sample documentation.

5.8.1 Sample Packaging and Shipment

Preparation of Sample Coolers

1. Remove all previous labels used on the cooler.
2. Seal all drain plugs with tape (inside and outside).
3. Place a cushioning layer of recyclable cornstarch popcorn or bubble wrap at the bottom of the cooler.
4. Line the cooler with a large plastic bag to contain samples.
5. Double-bag all ice in resealable plastic bags and seal.

Packing Samples in Coolers

1. Filled sample containers with completed labels will be sealed with custody seals, placed in labeled resealable plastic bags, and placed in a cooler containing ice. Glass bottles will be bubble-wrapped and placed into labeled, resealable plastic bags.
2. Custody seals will be placed over the lids of each sample container. Custody seals on the VOA vials will be placed around the lid to prevent covering the septum.
3. Place the chain-of-custody (COC) form in a resealable plastic bag and tape to the underside of the cooler lid.
4. Make sure that all glass sample containers are packaged in bubble wrap and secured with clear mailing tape.

5. Place samples in an upright position in the cooler.
6. Place ice on top of and between the samples.
7. Fill the remaining voids with recyclable cornstarch popcorn or double-bagged ice.
8. Custody-seal large plastic bag containing samples and packing material.

Closing and Shipping of Cooler

Coolers will be secured with packing tape and custody seals as described below.

1. Tape the cooler lid with strapping tape, encircling the cooler several times.
2. Place COC seals on two sides of the lid (one in front and one on the side).
3. Place "This Side Up" arrows on the sides of the cooler.

The coolers then will be shipped to the appropriate laboratory by overnight courier the day of sample collection. The sample shipment for each day will be reported to the EPA Region 9 Regional Sample Control Center (RSCC) Coordinator. For Friday shipments, the RSCC must be contacted prior to 12:00 p.m. to coordinate with laboratories that will receive sample shipments on Saturday. Samples will be shipped on Friday only if the laboratory provides assurance that analytical holding times will not be exceeded.

5.8.2 Sample Labeling

The following information will be written on each sample container label with a permanent marker and will be covered with clear plastic tape:

- Sample location number and CLP sample ID (if used)
- Case number (if applicable)
- Type of analysis requested
- Preservative used
- Date and time collected

For groundwater samples, a depth designation will be included. For example, the identification of sample 08-EPAGW-07-05-01-XXX is defined as follows:

08 = the year in which the sample was collected
EPAGW = EPA Groundwater Monitoring Well
07-05=Location 7 at 5 feet below ground surface
XXX = a unique sequential number to ensure unique sample identity

For soil boring samples, a depth designation will be included. For example, the identification of sample 08-EPASB-07-05-01-XXX is defined as follows:

08 = the year in which the sample was collected
EPASB = EPA Soil Boring
07-05=Location 7 at 5 feet below ground surface
XXX = a unique sequential number to ensure unique sample identity

For soil gas samples, a depth designation will be included. For example, the identification of sample 08-EPASG-07-05-01-XXX is defined as follows:

08 = the year in which the sample was collected

EPASG = EPA Soil Gas Probe
07-05=Location 7 at 5 feet below ground surface
XXX = a unique sequential number to ensure unique sample identity

Immediately following sample collection, the filled sample containers with completed labels will be sealed with custody seals, placed in resealable plastic bags, and placed in a cooler containing ice. VOA vials (three vials per sample) will be wrapped together in bubble wrap; secured with tape; and placed into labeled, resealable plastic bags. All other glass bottles will be bubble-wrapped and placed into labeled, resealable plastic bags.

5.8.3 Sample Documentation

Field Logbooks

Bound and numbered logbooks will be used to record all sampling information. Information in the logbooks will include, at a minimum, the following:

- Name and title of the recorder, and date and time of entry
- General description of weather conditions
- Personnel involved with the activities
- Photographic log, if appropriate
- Sampling location and description
- Location of duplicate and QC samples, date and time of collection, parameters to be analyzed; sample ID numbers; blank ID numbers; whether or not split samples were collected; and, if so, for whom
- Condition of well being sampled
- Rinsing the faucet head to remove any extraneous material
- Serial number and calibration of field instruments
- Parameter values obtained during purging
- Time of sampling
- Sample description
- Shipping addresses for laboratories
- Names of visitors, their associations, and purpose of visit
- Unusual activities such as departures from planned procedures
- References to important telephone calls

All logs will be completed, signed, and dated by the recorder. All logs will be written with waterproof ink. Corrections will be made by crossing out the error with a single horizontal line, initialing the correction, and entering the correct information. Crossed-out information shall be readable.

Chain-of-Custody Forms

COC procedures will be used to maintain and document sample collection and possession. COC forms will be filled out for all samples collected. A COC form will be completed and included with each sample shipment; the laboratory copy will be delivered with the cooler, and the duplicate copy will be retained by the sampling team member. All COC forms and custody seals will be signed and dated by the sampling team member.

Completed field QA/QC summary forms will be sent to the RSCC at EPA's Region IX QAO at the conclusion of the sampling event.

5.9 Disposal of Investigation Derived Waste

Types of wastes that may be derived from the field investigation activities include drill cuttings and fluids, development and purge water, used personal protective equipment, and disposable sampling equipment.

5.9.1 Drill Cuttings and Fluids

Drill cuttings and fluids will be stored onsite in temporary roll-off bins pending results from IDW sampling. The MP wells will be installed in residential/commercial areas where there is potentially low-level groundwater contamination, but substantive soil contamination should not be present. There is no reason to expect that the drill cuttings or drilling mud from these borings would be contaminated. Two composite IDW samples will be collected of the cuttings and the drilling mud from each MP well boring. The soil borings will be located in likely contaminant source areas. However, prior soil sampling has indicated that residual soil contamination is very limited. Two composite IDW samples will be collected of the drill cuttings from each soil boring. The composite IDW samples will be submitted for laboratory analyses. Based on the IDW results, the wastes will be transported offsite for at an appropriately classified waste facility approved to receive CERCLA wastes.

5.9.2 Development and Purge Water

Development and purge water will be stored at each MP well drilling location in temporary holding tanks pending results from sampling. One sample per storage container will be collected and submitted for laboratory analyses. The samples will be collected using a new, disposable polyethylene bailer to fill the appropriate sample containers. If the contaminant levels are below state and federal maximum contaminant levels, solids will be removed from the IDW water through settling or filtration and the water will be discharged to the storm drain system at the site. IDW water that exceeds MCLs will be transported offsite for treatment and disposal at a facility approved to receive CERCLA wastes.

5.9.3 Clothing and PPE

Disposable personal protective equipment and sampling equipment generated during the performance of the work will be cleaned off, bagged, and placed in a dumpster for disposal as municipal refuse.

5.10 Quality Control Samples

QC samples will be collected or prepared to assist in determining data reliability. QC samples include field duplicates, blanks, and laboratory QC samples (for MS/MSD). QC samples are normally collected from locations that are suspected to be of moderate contamination. QC samples will be collected concurrent with and using the same procedures as the collection of the target environmental sample.

5.10.1 Field Duplicates

A field duplicate is an independent sample collected as close as possible to the original sample from the same source and is used to document sampling precision. Field duplicates will be labeled and packaged in the same manner as other samples so that the laboratory cannot distinguish between samples and duplicates. Field duplicates will be collected by alternately filling sample and sample duplicate containers at a location of known or suspected contamination. Each duplicate will be taken using the same sampling and preservation method as other samples. Field duplicates will be collected at a minimum frequency of 1 in every 10 samples for groundwater, soil, and soil gas samples.

5.10.2 Blank Samples

One blank sample will be submitted each day that sampling is conducted. Blank samples are collected to verify that contamination is not introduced to samples during collection, handling, or shipping of the samples. Commercially prepared HPLC water will be used for organic analyses and reagent-grade deionized water will be used for inorganic analyses. Blanks will be prepared and labeled in the same manner as the field samples and sent "blind" to the laboratory. If sampling equipment is decontaminated and reused in the field (e.g., a temporary pump) or when a sample collection vessel (e.g., 250-ml Westbay sampling cylinders or a bailer) will be used, an equipment blank will be collected. Otherwise, a field blank (also called a field bottle blank) will be collected.

Equipment Blank

An equipment blank is collected by pouring the appropriate water into the decontaminated sampling equipment or vessel, then transferring the water to the sample bottles. For groundwater samples, the sampling equipment could be either a decontaminated pump, bailer or 250-mL Westbay cylinders. The same preservation methods, packaging, and sealing procedures as those used during collection of normal samples will be used.

Field Blank

A field blank is collected by pouring the appropriate blank water directly into the sample bottles at the sample location. Again, the same preservation methods, packaging, and sealing procedures as those used during collection of normal samples will be used.

5.10.3 Laboratory QC Samples

Laboratory QC samples will be collected to perform MS/MSD analyses. An MS is an aliquot of a sample spiked with a known concentration of target analyte(s) and provides a measure of accuracy. The MSD is a laboratory split sample of the MS and is used to determine the precision of the method.

Twice the normal water volume will be collected for laboratory QC samples. Laboratory QC samples will be labeled as such on sample bottles and paperwork. The MS/MSDs will be collected at the discretion of the field crew, at a frequency of 1 in every 20 consecutively collected samples for groundwater and soil samples.

Section 6
Health and Safety Plan

The Health and Safety Plan is included in Appendix B of this FSP.

Section 7
References

ENVIRON International Corporation. 2008. *Draft Remedial Investigation Report, 160-Acre Site*, Rialto, California. Prepared on behalf of Emhart Industries, Inc. September 30.

GeoLogic Associates. 2005. *Draft Interim Remedial Investigation/Feasibility Study – Perchlorate and VOC Impacts to Groundwater*. Rialto, California. September.

GeoLogic Associates. 2007. *Hydrogeologic Model of Perchlorate Transport Conditions in the Northern Rialto-Colton Basin*. San Bernardino County, California. March.

Geosyntec Consultants. 2006. *Draft Additional Interim Remedial Investigation Report*. 160-Acre Parcel and Surrounding Areas, Rialto, California. October.

Geosyntec Consultants. 2005. *Draft Remedial Investigation Report*. 160-Acre Parcel, Rialto, California. March.

Geosyntec Consultants. 2004 to 2008. *Goodrich Corporation Progress Report for the Months of May 2004 through March 2008*, 160-Acre Parcel, Rialto, California.

Science Applications International Corporation (SAIC). 2004. *Final Report, Operational History 1941-1945, Rialto Ammunition Back-Up Storage Point*, Rialto, California. January.

United States Environmental Protection Agency (EPA). 1994. *Guidance for the Data Quality Objectives Process.* EPA QA/G4. September.

United States Environmental Protection Agency (EPA). 2008a. *Quality Assurance Project Plan*. December.

United States Environmental Protection Agency (EPA). 2008b. *E-mail from Wayne Praskins (USEPA Project Manager) to David Towell (CH2M HILL Project manager)*. December 11.

United States Geologic Survey (USGS). 1997. *Geohydrology and Water Chemistry in the Rialto-Colton Basin, San Bernardino County, California.* Water-Resources Investigation Report 97-4012. Linda R. Woolfenden and Dina Kadhim. 1997.

Appendix A
Region 9 Sample Coordination Center Request

REGION 9 SAMPLE COORDINATION CENTER (RSCC)
SUPERFUND ANALYTICAL REQUEST FORM

Section 1

Project Name: B.F. Goodrich Site RI/FS		
Site Name: B.F. Goodrich Site	**SS ID:** 09JW	**OU:** Interim Source Area
[X] **RI/FS/RA** [ ] **Enforcement** [ ] **PA/SI** [ ] **Emergency Response** [ ] **Fed. Facilities**		
Proposed Sampling Dates: February 2009 – April 2011		
EPA Project Manager: Wayne Praskins	**Mail Code:** SFD-7-3	

Section 2

Sampling Organization (if other than above): CH2M HILL	
Mailing Address: 1000 Wilshire Blvd, 21st Floor, Los Angeles, CA 90017	
Project Manager: David Towell	**E-mail:** dtowell@ch2m.com
Office Phone: 213.228.8285	**Office Fax:** 213.538.1399
Sampler: Mike Ladeau **(if different from above):**	**E-mail:** mike.ladeau@ch2m.com
Office Phone: ---	**Mobile Phone:** 714.227.3324

Section 3

Title of QA plan or addendum to existing plan under which this sampling event will occur: DRAFT FIELD SAMPLING PLAN, B.F. GOODRICH SITE, RIALTO-COLTON GROUNDWATER BASIN, FIELD INVESTIGATION (December 2008) **EPA Quality Assurance Office DCN (if available):**

In compliance with EPA Order 5360.1, the EPA Region 9 Quality Management Plan, Section 1.1.2, states that, "An appropriate QA planning document … will be developed and approved for each environmental data collection activity prior to the initiation of data collection."

Section 4

Type of Data Deliverable	Data Distribution (include e-mail address if appropriate)
Hard copy report	1. Wayne Praskins/EPA Region 9 2. Dawn Richmond/EPA Region 9
Electronic report copy	1. Wayne Praskins/EPA Region 9 2. David Towell/CH2M HILL (dtowell@ch2m.com) 3. Jennifer Peterson/CH2M HILL (jpeter15@ch2m.com)
Electronic Data Deliverable (EDD) for R9 Lab Results*	3. Jennifer Peterson/CH2M HILL (jpeter15@ch2m.com)

Section 5
(Fill in table or attach copy of analytical description from Sampling and Analysis Plan)

Analysis (method, CLP SOW number, or R9 Lab SOP number)	Matrix (Sample Type)	No. of samples	TAT	Review/ Validation
Groundwater Sampling at Existing Wells (February 2009)				
VOCs (CLP SOW)	Groundwater	56	21 days	Tier 1A/1B 90% Tier 3 10%
Perchlorate	Groundwater	56	21 days	Tier 1A/1B 90% Tier 3 10%

Notes:
1) Above sample numbers include lab QCs, field duplicates, and field/equipment blanks.

Section 6
Include (or attach separately) any discussion of expanded or reduced analyte lists, required reporting limits, specialized preparation or analytical procedures, etc.

TABLE 1
Target Analyte List, Regulatory Goals, and Reporting Limits
B.F. Goodrich Site RI/FS

Volatile Organic Compounds

Analyte	CAS Number	Method	Reporting Limit-SOM01.2 (ug/L)	California MCL (ug/L)
1,1,1-Trichloroethane	71-55-6	SOM01.2	0.5	200
1,1,2,2-Tetrachloroethane	79-34-5	SOM01.2	0.5	1

TABLE 1

Target Analyte List, Regulatory Goals, and Reporting Limits
B.F. Goodrich Site RI/FS

Volatile Organic Compounds

Analyte	CAS Number	Method	Reporting Limit-SOM01.2 (ug/L)	California MCL (ug/L)
1,1,1-Trichloroethane	71-55-6	SOM01.2	0.5	200
1,1,2,2-Tetrachloroethane	79-34-5	SOM01.2	0.5	1
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	SOM01.2	0.5	1200
1,1,2-Trichloroethane	79-00-5	SOM01.2	0.5	5
1,1-Dichloroethane	75-34-3	SOM01.2	0.5	5
1,1-Dichloroethene	75-35-4	SOM01.2	0.5	6
1,2,3-Trichlorobenzene	87-61-6	SOM01.2	0.5	
1,2,4-Trichlorobenzene	120-82-1	SOM01.2	0.5	5
1,2-Dibromo-3-chloropropane	96-12-8	SOM01.2	0.5	0.2
1,2-Dibromoethane (EDB)	106-93-4	SOM01.2	0.5	0.05
1,2-Dichlorobenzene	95-50-1	SOM01.2	0.5	600
1,2-Dichloroethane	107-06-2	SOM01.2	0.5	0.5
1,2-Dichloropropane	78-87-5	SOM01.2	0.5	5
1,3-Dichlorobenzene	541-73-1	SOM01.2	0.5	
1,4-Dichlorobenzene	106-46-7	SOM01.2	0.5	5
1,4-Dioxane	123-91-1	SOM01.2	0.5	
2-Butanone (MEK)	78-93-3	SOM01.2	5	
2-Hexanone	591-78-6	SOM01.2	5	
4-Methyl-2-pentanone (MIBK)	108-10-1	SOM01.2	5	
Acetone	67-64-1	SOM01.2	5	
Benzene	71-43-2	SOM01.2	0.5	1
Bromochloromethane	74-97-5	SOM01.2	0.5	
Bromodichloromethane	75-27-4	SOM01.2	0.5	100
Bromoform	75-25-2	SOM01.2	0.5	100
Bromomethane	74-83-9	SOM01.2	0.5	
Carbon disulfide	75-15-0	SOM01.2	0.5	
Carbon tetrachloride	56-23-5	SOM01.2	0.5	0.5
Chlorobenzene	108-90-7	SOM01.2	0.5	70
Chlorodibromomethane	124-48-1	SOM01.2	0.5	

TABLE 1

Target Analyte List, Regulatory Goals, and Reporting Limits
B.F. Goodrich Site RI/FS

Volatile Organic Compounds				
Analyte	CAS Number	Method	Reporting Limit-SOM01.2 (ug/L)	California MCL (ug/L)
1,1,1-Trichloroethane	71-55-6	SOM01.2	0.5	200
1,1,2,2-Tetrachloroethane	79-34-5	SOM01.2	0.5	1
Chloroethane	75-00-3	SOM01.2	0.5	
Chloroform	67-66-3	SOM01.2	0.5	
Chloromethane	74-87-3	SOM01.2	0.5	
cis-1,2-Dichloroethene	156-59-2	SOM01.2	0.5	6
cis-1,3-Dichloropropene	10061-01-5	SOM01.2	0.5	0.5
Cyclohexane	110-82-7	SOM01.2	0.5	
Dichlorodifluoromethane	75-71-8	SOM01.2	0.5	
Dichloromethane	75-09-2	SOM01.2	0.5	5
Ethylbenzene	100-41-4	SOM01.2	0.5	300
Isopropyl benzene	98-82-8	SOM01.2	0.5	
m&p-Xylene	106-42-3	SOM01.2	0.5	1,750 (total xylenes)
Methyl acetate	79-20-9	SOM01.2	0.5	
Methyl-t-butyl ether	1634-04-4	SOM01.2	0.5	5
Metylcyclohexane	108-87-2	SOM01.2	0.5	
o-Xylene	95-47-6	SOM01.2	0.5	1,750 (total xylenes)
Styrene	100-42-5	SOM01.2	0.5	100
Tetrachloroethene	127-18-4	SOM01.2	0.5	5
Toluene	108-88-3	SOM01.2	0.5	150
trans-1,2-Dichloroethene	156-60-5	SOM01.2	0.5	10
trans-1,3-Dichloropropene	10061-02-6	SOM01.2	0.5	0.5
Trichloroethene	79-01-6	SOM01.2	0.5	5
Trichlorofluoromethane	75-69-4	SOM01.2	0.5	150
Vinyl chloride	75-01-4	SOM01.2	0.5	0.5
Wet Chemistry				
Perchlorate	014797-73-0	EPA Method 314	2.0	6

Appendix B
Health and Safety Plan

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HSP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 381696.BF.SA

CLIENT: EPA

PROJECT/SITE NAME: Rialto-Colton Field Investigation

SITE ADDRESS: San Bernardino County, CA (Cities of Rialto and Colton)

CH2M HILL PROJECT MANAGER: David Towell/LAC

CH2M HILL OFFICE: Los Angeles

DATE HEALTH AND SAFETY PLAN PREPARED: 12/13/2007

DATE(S) OF SITE WORK: January 2009-December 2011

SITE ACCESS: Public right of way and private property. Private property access to be arranged by EPA.

SITE SIZE: The geographical area to which the decision statement applies includes the eastern portion of the Rialto-Colton Basin in the vicinity of the 160-Acre Parcel.

SITE TOPOGRAPHY: flat, paved surface, buildings, fences

PREVAILING WEATHER: Sunny, warm-hot

SITE DESCRIPTION AND HISTORY:

This Health and Safety Plan (HSP) has been prepared to support field activities associated with Field Investigation work to be conducted in the eastern portion of the Rialto-Colton Basin and at the 160-Acre Parcel. The Field Investigation work is intended to provide data for evaluation of the nature and extent of contamination associated with the 160-Acre Parcel.

Background

The 40-square mile Rialto-Colton Groundwater Basin is located in western San Bernardino County, California, about 60 miles east of Los Angeles. It is bounded on the northwest and southeast by the San Gabriel Mountains and the Badlands, respectively. The San Jacinto Fault and Barrier E form the northeastern boundary, and the Rialto-Colton Fault forms the southwestern boundary. The Santa Ana River cuts across the southeastern part of the basin, and Warm and Lytle Creeks join the Santa Ana River near the eastern edge of the basin. Except in the southeastern part of the basin, the San Jacinto and Rialto-Colton Faults act as groundwater barriers that impede groundwater flow into and out of the basin (USGS, 1997). Barrier E generally does not impede groundwater flow into the basin.

Within the Rialto-Colton Basin, the 160-Acre Parcel is located in the southwest quadrant of Section 21, Township 1 North, and Range 5 West, of the USGS 7.5 minute series "Devore, California" quadrangle map. The site is square-shaped and bounded by West Casa Grande Drive on the north, Locust Avenue on the east, Alder Avenue on the west, and the extension of Summit Avenue on the south. Various buildings and structures are located throughout the site and several roadways run through the site, including West Lowell Street and other unimproved roads. The 160-Acre Parcel is now subdivided into smaller parcels with multiple property owners. Portions of the site are used for commercial and/or industrial purposes, and other areas are vacant or open space. The County of San Bernardino's Mid-Valley Sanitary Landfill is located immediately south and west of the 160-Acre Parcel. Adjacent properties to the north, east, west, and south are either undeveloped or developed with industrial facilities or residential buildings. Interstate I-210 is located approximately 0.5 miles to the south of the site, Interstate Freeway I-15 is approximately 1.5 miles to the northwest, and Interstate Freeway I-215 is located approximately 3 miles to the northeast. The Rialto Municipal Airport is approximately 1.5 miles south-southeast of the site.

Perchlorate and TCE have been detected in soil and soil gas at the 160-Acre Parcel and in groundwater at and downgradient of the 160-Acre Parcel. Contamination in this part of the Basin was first detected in 1997 when samples from the West Valley Water District (WVWD) Well No. 22 detected perchlorate at 820 micrograms per liter (µg/L) or parts per billion (ppb). Ongoing investigations are being conducted on the 160-Acre Parcel with peak perchlorate concentrations detected as high as 10,000 µg/L. The State of California recently adopted an MCL for perchlorate of 6 µg/L. TCE has been detected at a peak concentration of 420 µg/L in groundwater beneath the 160-Acre Parcel. This compares to an MCL of 5 µg/L. Perchlorate has been detected in City of Rialto groundwater production wells Nos. 1, 2, 4, and 6 which pump from the Rialto-Colton Groundwater Basin downgradient of the 160-Acre Parcel.

Perchlorate is an anion whose salts have been used in solid rocket propellant, munitions, explosives, fireworks, and other applications. Perchlorate salts are highly soluble in water and dissociate completely. The resulting perchlorate anion is non-volatile, highly mobile, and chemically stable in typical groundwater and surface water environments.

The perchlorate contamination emanating at the 160-Acre Parcel has resulted in a groundwater plume extending several miles downgradient of the site. The downgradient and lateral extent of the plume has not been fully quantified, however elevated levels of perchlorate (290 µg/L) and TCE (7 µg/L) are present at multiport monitoring well PW-9, located approximately 3 miles downgradient of the 160-Acre Parcel. Contamination at this location is present above the MCL at depths of more than 800 feet below ground.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

This Health and Safety Plan (HSP) has been prepared to support field activities associated with the Field Investigation to be conducted in the eastern portion of the Rialto-Colton Basin. The Field Investigation work is intended to provide data for evaluation of the nature and extent of contamination associated with the 160-Acre Parcel. Field activities will include sampling selected groundwater monitoring and water supply wells, installing and sampling new Multi-Port groundwater monitoring wells, drilling and sampling of soil borings, installation of permanent soil gas probes, and collection of soil gas samples.

Previous groundwater sampling and analysis in the Rialto-Colton Basin has shown that perchlorate and volatile organic compounds (VOCs), primarily trichloroethene (TCE), are present at concentrations exceeding State and/or Federal maximum contaminant levels (MCLs) in groundwater at and downgradient of the 160-Acre Parcel. Previous sampling has been conducted by various water agencies and Potentially Responsible Parties (PRPs).

The sampling data will be used to assess the distribution of contamination in the eastern portion of the Rialto-Colton Basin. These data will support ongoing evaluation of contamination conditions and guide additional remedial investigation (RI) activities. In addition, water level data will be collected to monitor groundwater flow directions and gradients.

Site Map

This page is reserved for a Site Map.

Note locations of Support, Decontamination, and Exclusion Zones; site telephone; first aid station; evacuation routes; and assembly areas.

Table of Contents

Project HS&E Change Management Form

This evaluation form should be reviewed on a ***continuous*** *basis to determine if the current site health and safety plan adequately addresses ongoing project work, and should be completed whenever new tasks are contemplated or changed conditions are encountered..*

Project Task:	**BF.FI**		
Project Number:	**381696**	Project/Task Manager:	**Vikas Mathur-TM**
Name:	**Rialto-Colton Field Investigation**	Employee #:	**32636**

	Evaluation Checklist	Yes	No
1.	Have the CH2MHILL staff listed in the original HSP/FSI changed?	x	
2.	Has a new subcontractor been added to the project?	x	
3.	Is any chemical or product to be used that is not listed in Attachment 2 of the plan?		x
4.	Have additional tasks been added to the project which were not originally addressed in the plan?	x	
5.	Have new contaminants or higher than anticipated levels of original contaminants been encountered?		x
6.	Have other safety, equipment, activity or environmental hazards been encountered that are not addressed in the plan?	x	

If the answer is "YES" to Question 3, an HSP/FSI revision is NOT needed. Please take the following actions:

- Add the chemical to Attachment 2, and ensure employees handling the chemical are trained, and training documentation is added to Attachment 3.

If the answer is "YES" to Questions 1, 2 or 4-6, an HSP/FSI revision MAY BE NEEDED. Please contact HS&E directly.

1 Tasks to be Performed Under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.1.1 Hazwoper-Regulated Tasks

- Groundwater monitoring and sampling
- IDW drum sampling
- IDW tank and roll-off bin sampling
- Multi-Port Monitoring Well drilling and construction
- Soil boring drilling and sampling
- Soil Gas Probe installation and sampling

1.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

TASKS

- Observe IDW drum, tank, and roll-off bin handling by Subcontractor
-
-

CONTROLS

- Brief on hazards, limits of access, and emergency procedures
- Post contaminant areas as appropriate (refer to Section 8.2 for details)
- Sample and monitor as appropriate (refer to Section 5.0)

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS					
	Soil Gas Probe Installation and Sampling	Multi-Port Well Drilling and Construction	Groundwater Monitoring and Sampling	IDW drum, tank, and roll-off bin sampling and disposal	Observation of loading material for offsite disposal	Soil Boring Drilling and Sampling
Flying debris/objects	X	X		X	X	X
Noise > 85dBA	X	X			X	X
Electrical	X	X	X			X
Suspended loads	X	X			X	X
Buried utilities, drums, tanks	X	X				X
Slip, trip, fall	X	X	X	X	X	X
Back injury	X	X	X	X		X
Confined space entry						
Trenches / excavations						
Visible lightning	X	X	X	X	X	X
Vehicle traffic	X	X	X	X	X	X
Elevated work areas/falls	X	X		X		X
Fires	X	X		X		X
Entanglement						
Drilling	X	X				X
Heavy equipment	X	X			X	X
Working near water						
Working from boat						
IDW Drum Sampling				X		

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: Weekly

Behavior Based Loss Prevention System

A Behavior Based Loss Prevention System (BBLPS is a system to prevent or reduce losses using behavior-based tools and proven management techniques to focus on behaviors or acts that could lead to losses. The Safety Coordinator (SC) and is responsible for implementing the BBLPS on the project site. The Safety Coordinator shall oversee the subcontractor’s implementation of their AHAs and PTSPs processes on the project.

Activity Hazard Analysis

An Activity Hazard Analysis (AHA) defines the activity being performed, the hazards posed and control measures required to perform the work safely. Workers are briefed on the AHA before doing the work and their input is solicited prior, during and after the performance of work to further identify the hazards posed and control measures required.

Activity Hazard Analysis will be prepared before beginning drilling using the AHA form provided in **Attachment 5**. The AHA shall identify the work tasks required along with potential H&S hazards and recommended control measures for each work task. In addition, a listing of the equipment to be used, inspection requirements and training requirements for the safe operation of the equipment listed must be identified. Subcontractors are required to provide AHA’s specific to drilling for acceptance by CH2M HILL. Additions or changes in field activities, equipment, tools or material to perform work or additional/different hazard encountered that require additional/different hazard control measures requires either a new AHA to be prepared or an existing AHA to be revised.

Pre-Task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/AHAs. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day’s activities, the crew supervisor completes the PTSP, provided in Attachment 5, with input from the work crew, during their daily safety meeting. The day’s tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required H&S procedures, as identified in the AHA. The use of PTSPs, better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry.

Safe Behavior Observations

The SC is required to submit weekly the SBO form on tasks conducted by staff and subcontractors. Frequency and amount to be determined by the HSM. Forms are in the attachments section.

2.1 Project-Specific Hazards

2.1.1 Exposure to Public Vehicular Traffic

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a contractor.

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route -- behind an established barrier, parked vehicle, guardrail, etc.
- Always pay attention to moving traffic – never assume drivers are looking out for you
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers. Vehicles should be parked at least 40 feet away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.

2.1.2 Drum Handling

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries.
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling.
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface.
- Ensure there are Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials.
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency.
- Supply operators with appropriate respiratory protective equipment when needed.
- Ensure that drums are secure and are not in the operator's view of the roadway.
- Prior to handling, all personnel should be warned about hazards of handling.
- Throughout handling, personnel should be alert for information leading to the identity of new hazards. Exercise extreme caution in handling drums that are not intact and tightly sealed.

- Before moving anything, determine the most appropriate sequence in which the various drums and other containers should be moved (e.g. small containers may have to be removed first to permit heavy equipment to enter and move the drums.
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur.

2.1.3 Drilling (Reference CH2M HILL SOP *Drilling*)

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.

2.1.4 Fall Protection (Reference CH2M HILL SOP *Fall Protection*)

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet or greater and when performing general industry activities at a height of 4 feet or greater.
- Staff exposed to fall hazards must complete the CH2M HILL Fall Protection training course and receive project-specific fall protection training. Do not use fall protection systems on which you have not been trained.
- The SSC/DSC must complete the Project Fall Protection Evaluation Form and provide project-specific fall protection training to all staff exposed to fall hazards. The Project Fall Protection Evaluation Form is provided in Attachment 4 of this plan.
- The SSC/DSC shall act as competent person and shall inspect and oversee the use of fall protection systems. Follow all requirements established by the competent person for the use and limitation of fall protection systems.
- A registered professional engineer shall oversee the use of horizontal lifelines.
- Only one person shall be simultaneously attached to a vertical lifeline.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted.
- Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Inspect personal fall arrest systems prior to each use. Do not use damaged fall protection systems at any time, or for any reason.
- Set-up personal fall arrest systems so that you can neither free-fall more than 6 feet nor contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds.
- Use fall protection equipment for fall protection only and not to hoist materials. Do not use personal fall arrest systems that have been subjected to impact loading.

2.1.5 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles or project vehicles.
- Emergency kits are available in all NWR offices for personal and rental vehicles. Fleet vehicles are equipped with emergency supplies. It is a project responsibility to equip all project vehicles with emergency equipment.
- **Maintain both a First Aid kit and Fire Extinguisher in the field vehicle at all times.**
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Car rental must meet the following requirements:
  - Dual air bags
  - Antilock brakes
  - Be midsize or larger.
- Familiarize yourself with rental vehicle features.

    - Mirror adjustments
    - Seat adjustments
    - Cruise control features, if offered.
    - Pre-program radio stations.
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van.
- Pull off the road, put the car in park and tun on flashers before talking on a mobile phone.
- Close car doors slowly and carefully. Fingers can get pinched in doors or the truck.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.

2.1.6 Noise Hazards

Previous surveys indicate that heavy equipment such as drilling or excavation equipment may produce continuous and impact noise at or above the action level of 85 dBA. All CH2M HILL personnel within 25 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, shall wear hearing protective devices (either muffs or plugs). Personnel will wash their hands with soap and water prior to inserting ear plugs to avoid initiating ear infections. Additional information regarding CH2M HILL's Hearing Conservation Program is located in HS-108 of the CH2M HILL Corporate Health and Safety Program, Program and Training Manual. Access to this document can be easily obtained on the CH2M HILL H&S Intranet Site.

2.2 General Hazards

2.2.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-209, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

(Reference CH2M HILL SOP HS-107, *Hazard Communication)*

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods)*

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.2.4 Lifting

(Reference CH2M HILL SOP HS-112, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
  - Plan storage and staging to minimize lifting or carrying distances.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.2.5 Fire Prevention

(Reference CH2M HILL SOP HS-208, *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.6 Electrical

(Reference CH2M HILL SOP HS-206, *Electrical*)

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - equipped with third-wire grounding.
  - covered, elevated, or protected from damage when passing through work areas.
  - protected from pinching if routed through doorways.
  - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to

prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.2.7 Stairways and Ladders

(Reference CH2M HILL SOP HS-214, *Stairways and Ladders*)

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials
- Straight and extension ladders must be tied off to prevent displacement
- Ladders that may be displaced by work activities or traffic must be secured or barricaded
- Portable ladders must extend at least 3 feet above landing surface
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder
- Stepladders are to be used in the fully opened and locked position
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder
- Fixed ladders $\geq$ 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

2.2.8 Heat Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50^{o}F to 60^{o}F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool– but not cold– water. Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.
The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

2.2.9 Cold Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, hypothermia should consult the SSC/DSC to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**

Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

2.2.10 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.2.11 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: Underground Service Alert (Digalert)
Phone: 811

Name: Spectrum Geophysics
Phone: (818) 565-3590

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change n advancement of auger or split spoon).
- When the client or other onsite party is responsible for determining the presence and locations of buried utilities, the SSC should confirm that arrangement.

2.3 Biological Hazards and Controls

2.3.1 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Oak

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-202, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.3.6 Other Anticipated Biological Hazards

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Perchlorate (See MSDS for Sodium Perchlorate)	GW:1,400 ppb SB: 760 ug/kg SS:	NL	NL	**Eye:** May cause eye irritation. Causes redness and pain. **Skin:** May cause skin irritation. May be harmful if absorbed through the skin. **Ingestion:** Harmful if swallowed. May cause nausea and vomiting. **Inhalation:** May cause respiratory tract irritation. May be harmful if inhaled. **Chronic:** May cause liver and kidney damage.	
Trichloroethylene (TCE)	GW:180 ppb SB: SS: SG: 1.7 ug/L	50 ppm	1,000 Ca	Headache, vertigo, visual disturbance, eye and skin irritation, fatigue, giddiness, tremors, sleepiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury	9.45

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water), SG (Soil Gas).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified “Exposure Limit” units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-113, *Medical Surveillance,* and HS-110, *Health and Safety Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-120, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Mike Ladeau	RIV	Team lead	Level C, SC-HW, FA/CPR
Dan Jablonski	LAC	SC	Level C, SC-HW, FA/CPR
Mike Palm	SCO	Team member	Level C, SC-HW
Vikas Mathur	SCO	Task Manager	Level C, SC-HW, FA/CPR
David Towell	LAC	Project Manager	

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: Mr. Wayne Praskins/US EPA Project Manager
Phone: 415/972-3181
Facility Contact Name:
Phone:

3.2.2 CH2M HILL

Project Manager: David Towell/LAC (213) 228-8285
Health and Safety Manager: Rick Cavil/BAO (408) 896-0140
Field Team Leader: Mike Ladeau/RIV (714) 227-3324
Site Safety Coordinator: Vikas Mathur/SCO (714) 435-6110
The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-215, *Subcontractor, Contractor, and Owner*)

Subcontractor: TBD (Borehole Drilling, Well Construction, Soil Sampling, Soil Gas Probe Installation)
Subcontractor Contact Name: TBD
Telephone: TBD

Subcontractor: Enviroserve (IDW Drum Handling and Disposal)
Subcontractor Contact Name: John Morris
Telephone: 562-427-7277

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

3.2.4 Contractors

(Reference CH2M HILL SOP HS-215, *Subcontractor, Contractor, and Owner*)

Contractor:
Contractor Contact Name:
Telephone:

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (e.g., advising on H&S issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative

- Request that the contractor determine and implement corrective actions
- If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.

- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-117, *Personal Protective Equipment*,)

PPE Specifications [a]

Tasks	Level	Body	Head	Respirator [b]
General site entry Observation of material loading for offsite disposal Oversight of remediation and construction Well drilling and construction Soil boring drilling and Soil Gas Probe installation	D	Work clothes; steel-toe, leather work boots; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
Groundwater sampling Investigation-derived waste (drum, tank, rollo-off bin) sampling and disposal	Modified D	**Coveralls:** Uncoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Safety glasses Ear protection [d]	None required.
Tasks requiring upgrade Any tasks where PID monitoring exceeds action limits.	C	**Coveralls:** Polycoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent[e].
Tasks requiring upgrade	B	**Coveralls:** Polycoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	Positive-pressure demand self-contained breathing apparatus (SCBA); MSA Ultralite, or equivalent.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SSC.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-207, Exposure *Monitoring)*

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
PID: OVM with 10.6eV lamp or equivalent	Sampling, drilling	< 10 ppm > 10 ppm ppm	Level D Level C, contact HSM Level B	Initially and periodically during task	Daily

[a] Action levels apply to sustained breathing-zone measurements above background.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., “Breathing Zone/MW-3”, “at surface/SB-2”, etc.).

[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (refer to Section 2).

[d] Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

[e] Noise monitoring and audiometric testing also required.

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

N/A

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM:
Other:

6 Decontamination

(Reference CH2M HILL SOP HS-*Decontamination*)

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel

- Boot wash/rinse
- Glove wash/rinse
- Outer-glove removal
- Body-suit removal
- Inner-glove removal
- Respirator removal
- Hand wash/rinse
- Face wash/rinse
- Shower ASAP
- Dispose of PPE in municipal trash, or contain for disposal
- Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal

Sample Equipment

- Wash/rinse equipment
- Solvent-rinse equipment
- Contain solvent waste for offsite disposal

Heavy Equipment

- Power wash
- Steam clean
- Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.

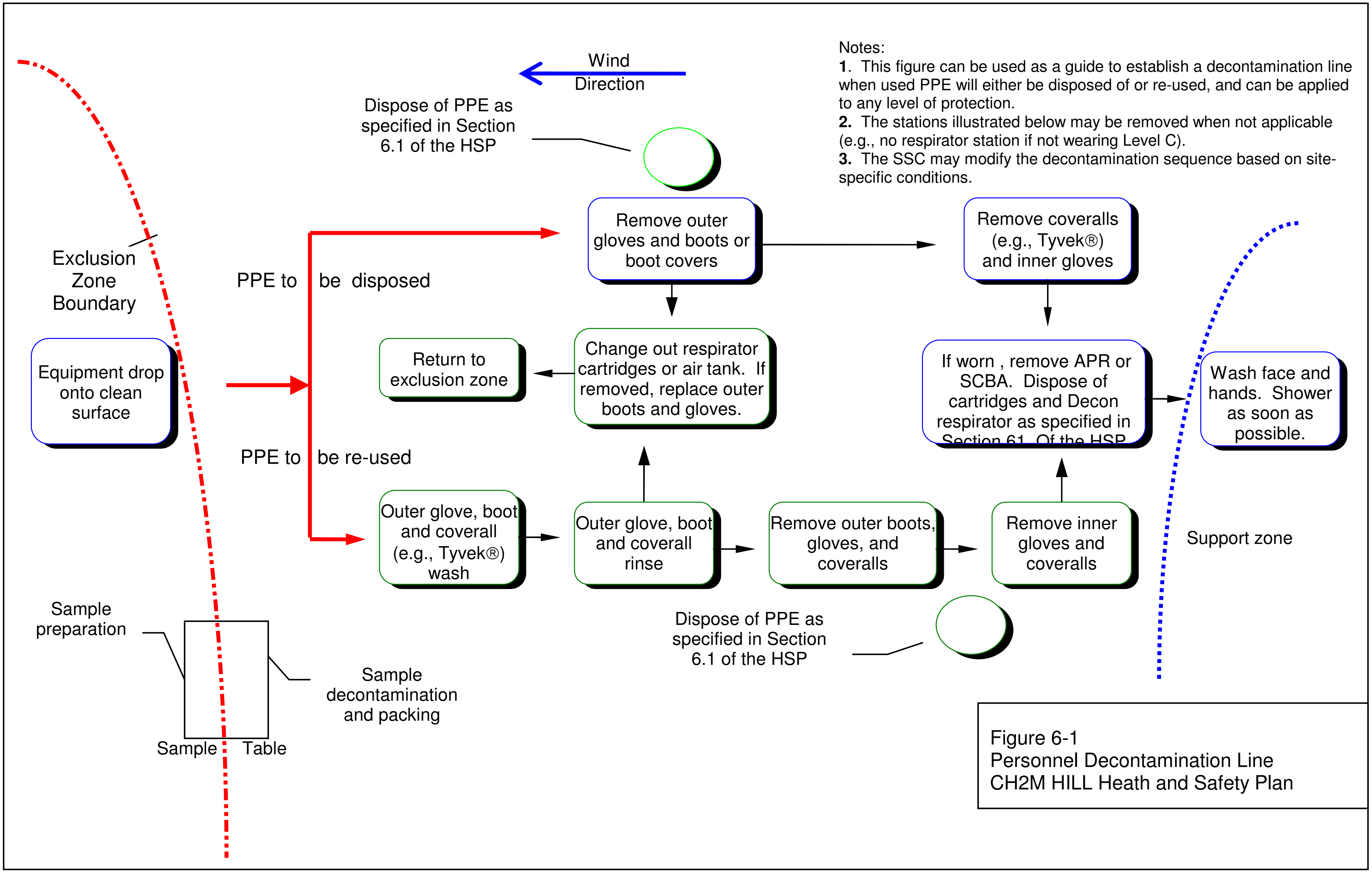


Figure 6-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-*Site Control)*

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-*Site-Specific Written Safety Plans)*

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-*Emergency Response*)

9.1 Pre-Emergency Planning

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	Cell phone

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

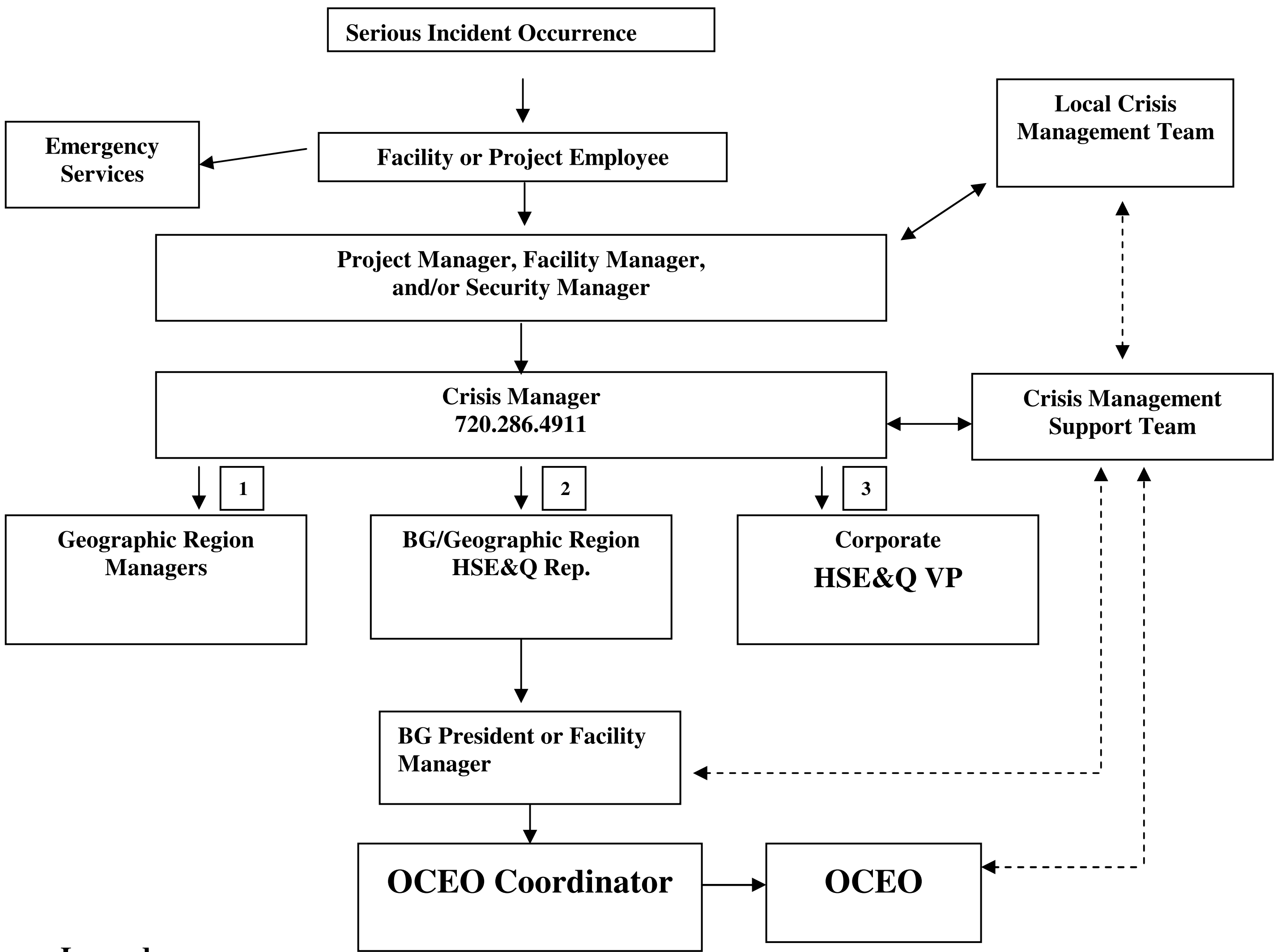
Injury Reporting

- If a CH2M HILL employee is injured immediately notify their group leader.
- Call the CH2M HILL Occupational Health Nurse **1-800-756-1130**
- In case of emergency call 911.

Incident Notification and Reporting

- Upon any other project incident (fire, spill, , near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- Notify and submit reports to client as required in contract.
- Serious Incidents must be reported in accordance with CH2M HILL Standard of Practice, *Serious Incident Reporting Process,* immediately. Serious incidents are those that involve any of the following:
  - Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public
  - Kidnap/missing person
  - Acts or threats of terrorism
  - Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage.
  - Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment

Serious Incident Notification Chart



Legend:

Direct line of communication

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: Rick Cavil/BAO, CSP **Date: 12/14/2007**

Approved By: ***Rick Cavil/BAO, CSP*** **Date: 12/18/2007**

10.2 Revisions

Revisions Made By: Vikas Mathur & Rick Cavil **Date: 12-06-2008**

Revisions to Plan: Additional field tasks, subcontractor and revised staff list, new hazard sections, updated PPE sections, updated Air monitoring section,

---

Revisions Approved By: ***Rick Cavil, CSP*** **Date: 12/17/2008**

---

11 Attachments

Attachment 1: **Employee Signoff Form – Field Safety Instructions**
Attachment 2: **Project-Specific Chemical Product Hazard Communication Form**
Attachment 3: **Chemical-Specific Training Form**
Attachment 4: **Emergency Contacts**
Attachment 5: **Project H&S Forms/Permits**
Attachment 6: **Project Activity Self-Assessment Checklists**
Attachment 7: **Applicable Material Safety Data Sheets**

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Rialto-Colton Groundwater Characterization Study **Project Number:** 381696

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: Rialto-Colton Field Investigation **Project Number:** 381696.BF,FI

MSDSs will be maintained at the following location(s): With HSP

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Methane	1 liter, compressed	Support Zone			
Isobutylene	1 liter, compressed	Support Zone			
Pentane	1 liter, compressed	Support Zone			
Hydrochloric acid	< 500 ml	Support Zone / sample bottles			
Nitric acid	< 500 ml	Support Zone / sample bottles			
Sulfuric Acid	< 500 ml	Support Zone / sample bottles			
Sodium hydroxide	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
pH buffers	< 500 ml	Support Zone			
MSA Sanitizer	< 1 liter	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			
IsoPropyl Alcohol	< 1 liter	Support Zone (Soil gas)			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # : 381696.BF,FI
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 720-286-4911

24- hour CH2M HILL Injury Reporting- 1800-756-1130

Medical Emergency – 911 Facility Medical Response #: Local Ambulance #:	**CH2M HILL Medical Consultant** Health Resources Dr. Jerry H. Berke, M.D., M.P.H. 600 West Cummings Park, Suite 3400 Woburn, MA 01801-6350 1-800-350-4511 (0800-2300 EST, M-F) all other times 1-800-978-7003 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency -- 911 Facility Fire Response #: Local Fire Dept #:	**Corporate Director Health, Safety & Environment** Name: Andy Strickland/DEN Phone: 1720-286-2393 **24-hour emergency beeper: 720-286-4911**
Security & Police – 911 Facility Security #: Local Police #:	**Regional Health & Safety Manager (RHSM)** Name: Rick Cavil/BAO Cell 408-896-0140
Safety Coordinator (SC) Name: Vikas Mathur/SCO Phone: 714-697-6565 (Cell)	**Regional Human Resources Department** Name: Lisa Covey/SAC Phone: 916/286-0253
Project Manager (PM) Name: David Towell/LAC Phone: 213.228.8285 (Office)	**Corporate Human Resources Department** Name: Pete Hannan/COR Phone: 720-286-3077
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation:** Contact Regional HR dept. to have form completed or contact Julie Zimmerman after hours: 720-286-2375 **Automobile Accidents:** Rental: Linda Anderson/COR 720-286-2401 CH2M HILL vehicle: Zurich Ins. Co. 800-987-3373

Contact the PM. Generally, the PM will contact relevant government agencies.

Facility Alarms:	**Evacuation Assembly Area(s):**

Facility/Site Evacuation Route(s):

Hospital Name/Address: Inland Urgent Care 1800 Medical Center Dr. San Bernardino, CA 92411	**Hospital Phone #:** (909) 473-1700

Directions to Hospital


YAHOO!
210
Foothill Fwy
W Highland Ave
Cajon Blvd
San Bernardino
City School
W 21st St
W 20th St
Goodlett St
N California St
Little Zion
Manor Dr
Flores St
Dr Howard B
Inghram Elem School
Community
Hospital-San Bernardino
N Pico Ave
Herrington Ave
N Mt Vernon Ave
W 19th St
N Pennsylvania Ave
Community Hosp-
San Bernardino-ER
A
H
Western Ave
Clyde
St
Arizona Ave
Bradley Ct
Susie Ln
Orangewood
Park
Medical Center Dr
W 17th St
W 17th St
Cabrera Ave
St Anthony's
School
W Trenton St
Cummings
Way
W 16th St
W 16th St
Clyde
St
Glenview St
Ellsworth
Way
Massaro Ln
Hancock St
W Evans St
W Gilbert St
Western Ave
W 15th St
W 15th
St
500 m
1000 ft
©Yahoo! 2007,Data©Navteq 2007

Project H&S Forms and Permits

CH2MHILL

Pre-Task Safety Plan (PTSP)

Project: ______________________Location:______________________Date:_________________________

Supervisor: ____________________________ Job Activity:_____________________________________

____

Task Personnel:

____

____

____

____

List Tasks:

____

____

____

____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

____

____

____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

____

____

____

____

CH2MHILL

Hazard Control Measures (Check All That Apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Cranes and rigging	Training: __ Hazwaste __ Construction __ Competent person __ Task-specific (THA) __ Hazcom
Field Notes:____ ____ ____			

Name (Print): ______________________________

Signature:______________________________ Date:________________

CH2MHILL

Safe Work Observation Form

Project:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	**Safe**	**At-Risk**	**Observations/Comments**
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists

HS&E Self-Assessment Checklist—TRAFFIC CONTROL

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees are exposed to traffic hazards and/or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to traffic hazards.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of traffic control operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: ______________________ Project No.: ____________

Location: ______________________ PM: ____________

Auditor: ______________ Title: ______________ Date: ________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to traffic hazards.
☐ Evaluate a CH2M HILL subcontractor's compliance with traffic control requirements.
Subcontractors Name: ______________________

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-216.

SECTION 1

SAFE WORK PRACTICES (3.1)	Yes	No	N/A	N/O
1. Personnel working on/adjacent to active roadways or in control zones are wearing safety vests.	☐	☐	☐	☐
2. Traffic control plan (TCP) is consistent with roadway, traffic, and working conditions.	☐	☐	☐	☐
3. TCP has been approved by regulatory or contractual authority prior to work.	☐	☐	☐	☐
4. TCP considers all factors that may influence traffic related hazards and controls.	☐	☐	☐	☐
5. Work areas are protected by rigid barriers.	☐	☐	☐	☐
6. Lookouts are used when applicable.	☐	☐	☐	☐
7. Vehicles are parked 40 feet away from work zone or are equipped with hazard beacon/strobe.	☐	☐	☐	☐
8. TMCC or TMA vehicle is used where appropriate.	☐	☐	☐	☐
9. All CH2M HILL traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
10. Traffic control devices are inspected continuously.	☐	☐	☐	☐
11. Flagging is only used when other means of traffic control are inadequate.	☐	☐	☐	☐
12. Additional traffic control zone controls have been implemented.	☐	☐	☐	☐
13. Cranes do not swing loads/booms over nor do workers enter/cross live roadways (as defined).	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
14. Lane closings are performed when required by this SOP.	☐	☐	☐	☐
15. Traffic control configurations are based on an engineering study of the location.	☐	☐	☐	☐
16. If no study, traffic control is performed with approval of the authority having jurisdiction.	☐	☐	☐	☐
17. TCP has been prepared and understood by all responsible parties prior to work.	☐	☐	☐	☐
18. Special preparation/coordination with external parties has been conducted where applicable.	☐	☐	☐	☐
19. All contractor traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
20. Traffic movement and flow are inhibited or disrupted as little as possible.	☐	☐	☐	☐
21. Supplemental equipment and activities do not interfere with traffic.	☐	☐	☐	☐
22. Drivers and pedestrians are considered when entering and traversing traffic control zone.	☐	☐	☐	☐
TRAFFIC CONTROL ZONES (3.2.2)				
23. Traffic control zones are divided into the necessary five areas.	☐	☐	☐	☐
24. Advances warning area is designed based on conditions of speed, roadways, and driver needs.	☐	☐	☐	☐
25. Advanced warning signage is spaced according to roadway type and conditions.	☐	☐	☐	☐
26. Transition areas are used to channelize traffic around the work area.	☐	☐	☐	☐
27. Buffer areas are used to provide a margin of safety for traffic and workers.	☐	☐	☐	☐
28. The buffer area is free of equipment, workers, materials, and worker vehicles.	☐	☐	☐	☐
29. The length of the buffer area is two times the posted speed limit in feet.	☐	☐	☐	☐
30. All work is contained in the work area and is closed to all traffic.	☐	☐	☐	☐
31. A termination area is used to provide traffic to return to normal lanes.	☐	☐	☐	☐
32. A downstream taper is installed in the termination area.	☐	☐	☐	☐
DEVICE INSTALLATION AND REMOVAL (3.2.3)				
33. All vehicles involved with device installation/removal have hazard beacons/strobes.	☐	☐	☐	☐
34. Devices are installed according to the order established by this SOP.	☐	☐	☐	☐
35. Devices are removed in the opposite order of installation.	☐	☐	☐	☐
36. Tapers are used to move traffic out of its normal path.	☐	☐	☐	☐
37. Tapers are created using channelizing devices.	☐	☐	☐	☐
38. The length of taper is determined by posted speed and width of lane to be closed (see formula).	☐	☐	☐	☐
39. Local police or highway patrol assist during taper installation and removal.	☐	☐	☐	☐
40. TMCC/ TMA vehicles are used to protect personnel during installation and removal of devices.	☐	☐	☐	☐
41. Cone trucks are equipped with platforms and railings.	☐	☐	☐	☐
42. Cones are the appropriate height for the specific roadway and are reflectorized.	☐	☐	☐	☐
43. Temporary sign supports are secured using sandbags to prevent movement.	☐	☐	☐	☐
44. Arrow panels are used on lane closures where required.	☐	☐	☐	☐
45. Concrete barriers are used where required.	☐	☐	☐	☐
46. Barrels, crash cushions, or energy absorbing terminals are used to protect traffic as required.	☐	☐	☐	☐
47. Changeable message signs (CMS) are used as required.	☐	☐	☐	☐
48. CMS are not used to replace required signage.	☐	☐	☐	☐
49. No more than two message panels are used in any message cycle on CMS.	☐	☐	☐	☐
FLAGGING (3.2.4)				
50. Flagging is used only when other traffic control methods are inadequate.	☐	☐	☐	☐
51. Only approved personnel with current certification are allowed to be used as flaggers.	☐	☐	☐	☐
52. Flaggers are located off the traveled portion of the roadway.	☐	☐	☐	☐
53. A communication system is established when more than one flagger is used.	☐	☐	☐	☐
54. Hand signaling by flaggers is by means of red flags, sign paddles, or red lights.	☐	☐	☐	☐
55. Flaggers are alert, positioned close enough to warn work crews, and easily identified from crew.	☐	☐	☐	☐
56. An escape plan is established by crew and flaggers prior to traffic control set up.	☐	☐	☐	☐
57. Signs indicating a flagger is present are used and removed as required.	☐	☐	☐	☐

We will only maintain controlled copies online. Printed versions of this document are uncontrolled copies. To ensure you have the current version, use the copy found at: http://www.int.ch2m.com/safety_counts/HS_SOP_Manual/Manual.html

SECTION 2	Yes	No	N/A	N/O
INSPECTION AND MAINTENANCE (3.2.5)				
58. Traffic control zones are monitored to determine their effectiveness under varying conditions.	☐	☐	☐	☐
59. Traffic control devices are inspected at the beginning and continuously during work shift.	☐	☐	☐	☐
60. Traffic control devices are restored to their proper position immediately and continuously.	☐	☐	☐	☐
61. Damaged, old, or ineffective devices are removed and replace immediately and continuously.	☐	☐	☐	☐
62. Devices using reflected light for illumination are cleaned and monitored continuously.	☐	☐	☐	☐

We will only maintain controlled copies online. Printed versions of this document are uncontrolled copies. To ensure you have the current version, use the copy found at: http://www.int.ch2m.com/safety_counts/HS_SOP_Manual/Manual.html

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ________________________________ Project Manager: ___________________________________

We will only maintain controlled copies online. Printed versions of this document are uncontrolled copies. To ensure you have the current version, use the copy found at: http://www.int.ch2m.com/safety_counts/HS_SOP_Manual/Manual.html

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name: ______________________ Project No.: ______________

Location: ______________________ PM: ______________________

Auditor: ______________ Title: ______________ Date: __________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
☐ Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling safety requirements (complete entire checklist).
Subcontractors Name: ______________________

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-204.

SECTION 1 - SAFE WORK PRACTICES (4.1)

	Yes	No	N/A	N/O
1. Personnel cleared during rig startup	☐	☐	☐	☐
2. Personnel clear of rotating parts	☐	☐	☐	☐
3. Personnel not positioned under hoisted loads	☐	☐	☐	☐
4. Loose clothing and jewelry removed	☐	☐	☐	☐
5. Smoking is prohibited around drilling operation	☐	☐	☐	☐
6. Personnel wearing appropriate personal protective equipment (PPE), per written plan	☐	☐	☐	☐
7. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐

SECTION 2 - SUPPORT FUNCTIONS (4.2)

FORMS/PERMITS (4.2.1)

	Yes	No	N/A	N/O
8. Driller license/certification obtained	☐	☐	☐	☐
9. Well development/abandonment notifications and logs submitted and in project files	☐	☐	☐	☐
10. Water withdrawal permit obtained, where required	☐	☐	☐	☐
11. Dig permit obtained, where required	☐	☐	☐	☐

UTILITY LOCATING (4.2.2)

	Yes	No	N/A	N/O
12. Location of underground utilities and structures identified	☐	☐	☐	☐

We will only maintain controlled copies online. Printed versions of this document are uncontrolled copies. To ensure you have the current version, use the copy found at: http://www.int.ch2m.com/safety_counts/HS_SOP_Manual/Manual.html

SECTION 2 (Continued)

WASTE MANAGEMENT (4.2.3)	Yes	No	N/A	N/O
13. Drill cuttings and purge water managed and disposed properly	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	☐	☐	☐	☐
15. Appropriate decontamination procedures being followed, per project's written safety plan	☐	☐	☐	☐
DRILLING AT MUNITIONS RESPONSE (4.2.5)				
16. MEC plan prepared and approved	☐	☐	☐	☐
17. MEC avoidance provided, routes and boundaries cleared and marked	☐	☐	☐	☐
18. Initial pilot hole established by UXO technician with hand auger	☐	☐	☐	☐
19. Personnel remain inside cleared areas	☐	☐	☐	☐
SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)				
GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	☐	☐	☐	☐
21. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
22. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	☐	☐	☐	☐
24. Safe clearance distance maintained from overhead power lines	☐	☐	☐	☐
25. Drilling pad established, when necessary	☐	☐	☐	☐
26. Drill rig leveled and stabilized	☐	☐	☐	☐
27. Additional precautions taken when drilling in confined areas	☐	☐	☐	☐
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
29. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
30. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
31. Safe clearance distance maintained while traveling under overhead power lines	☐	☐	☐	☐
32. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	☐	☐	☐	☐
34. All machine guards are in place	☐	☐	☐	☐
35. Rig ropes not wrapped around body parts	☐	☐	☐	☐
36. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
37. Drill operation stopped during inclement weather	☐	☐	☐	☐
38. Air monitoring conducted per written safety plan for hazardous atmospheres	☐	☐	☐	☐
39. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	☐	☐	☐	☐
41. Equipment and tools properly stored	☐	☐	☐	☐
42. All vehicles locked and keys removed	☐	☐	☐	☐
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	☐	☐	☐	☐
29. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
30. Cathead in clean, sound condition	☐	☐	☐	☐
31. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	☐	☐	☐	☐
33. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
34. Good housekeeping maintained on and around rig	☐	☐	☐	☐

SECTION 4

Complete this section for all items checked "No" in previous sections. Deficient items must be corrected in a timely manner.

Item #	**Corrective Action Planned/Taken**	**Date Corrected**

Auditor: ______________________________ Project Manager: ________________________________

We will only maintain controlled copies online. Printed versions of this document are uncontrolled copies. To ensure you have the current version, use the copy found at: http://www.int.ch2m.com/safety_counts/HS_SOP_Manual/Manual.html

Applicable Material Safety Data Sheets

Appendix C
Responses to EPA QAO Comments (02/26/09)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco, CA 94105

February 26, 2009

MEMORANDUM

SUBJECT: Response to Comments on the "Field Sampling Plan, BF Goodrich Site, Rialto-Colton Groundwater Basin, Field Investigation, San Bernardino County, California," December 2008, DCN#ZZCA0199SV1.

FROM: Wayne Praskins, Remedial Project Manager,
Site Cleanup Section 3, SFD-7-3

TO: Rich Freitas, Environmental Scientist
Quality Assurance Office, PMD-3

We have reviewed your comments, dated February 11, 2009, on the December 2008 Field Sampling Plan prepared by CH2M Hill, Inc. We offer the following responses. Please contact me at (415) 972-3181 with any questions.

1. Comment: Available lithologic and/or geophysical log information should be used to support the interpretation of the area hydrogeology, aquifer zones and thus potential contaminant transport pathways. If hydrogeologic sections can not be draw then boring logs can be strung along a line of section to illustrate subsurface geology and interpreted aquifer zones. This may help to support the delineation of the aquifer subunits, affected zones of contamination and depths from which water supply wells draw their water. Some of this information might be found in previous reports which could briefly be summarized in the field sampling plan.

Response: Attached are three cross sections prepared by DPRA Inc., summarizing information from boring logs and other field efforts. The figures are labeled Figures 2, 3a, 3b, and 3c, and are taken from a report titled "Draft Site Inspection Report, Perchlorate, Trichloroethene and Other Hazardous Substances Within the Rialto-Colton Groundwater Basin County of San Bernardino, California," dated April 22, 2008. The three cross-sections present the interpreted subsurface lithology, measured water levels, and simplified depictions of the distribution of perchlorate contamination in the Basin. The cross-sections highlight the large vertical head differences observed in the northern portion of the basin beneath the 160-Acre Area and the lack of vertical head variability in the downgradient areas. The sections also depict the apparent, distinct deep perchlorate plume that is isolated from the more extensive shallower contamination.

<u>2. Comment</u>: [Page 2-3, 2nd paragraph, "Groundwater generally moves from northwest to southeast in the middle and lower water-bearing units. Two major interior faults, Barrier J and an unnamed fault, affect groundwater movement (USGS, 1997). Groundwater moves across Barrier J in the unfaulted part of the groundwater system. The unnamed fault is a partial barrier to groundwater movement in the middle water-bearing unit and an effective barrier in the lower water-bearing unit. Water flows across the unnamed fault above the saturated zone."

Groundwater elevation contour maps should be provided in support of the interpreted groundwater flow direction(s) for each aquifer zone. Knowledge of groundwater flow direction(s) is important for proper placement of the multiport wells and proper interpretation of the groundwater analytical data. Existing water level data from monitor wells and other short screened wells would be useful for this purpose whereas data long screened wells which penetrate both B and C zones may not be as useful.

<u>Response</u>: Attached are three water level contour maps prepared by other (non-EPA) parties:

- The figure labeled Figure 9, "Groundwater Equipotential Contours for the Shallow Aquifer, B Zone," shows interpreted water levels in the Intermediate Aquifer (the "B zone"), using data from August 2006. The figure, prepared by GeoSyntec Consultants, shows groundwater generally moving from the source area (the 160 acre parcel) to the southeast. The area where the contours are shown includes the location of one of the planned wells (EPA-A). The report is titled "Draft Additional Interim Remedial Investigation Report," dated 21 October 2006.

- The figure labeled Figure 10, "Groundwater Equipotential Contours for the Regional Aquifer, C Zone," shows interpreted water levels in the Regional Aquifer (the "C zone"), using data from August 2006. The figure, prepared by GeoSyntec Consultants, shows groundwater generally moving from the source area (the 160 acre parcel) to the southeast. The area where the contours are shown includes the locations of three of the planned wells (EPA-A, B, C).

- The figure labeled Figure 4d, "Groundwater Elevation Contours, Colton-Rialto Basin, February-March 2008," shows interpreted water levels in the Regional Aquifer (the "C zone"), using data from February and March 2008. The figure, prepared by DPRA, shows groundwater generally moving from the source area (the 160 acre parcel) to the southeast, and a portion of the flow turning more southerly several miles from the source area.. The area where the contours are shown includes the locations of four of the planned wells (EPA-D, E, F, G).

There is considerable uncertainty about the locations of the water level contours (and the associated groundwater flow conditions) shown on the figures due to limited data, particularly in the area approximately three to 4 ½ miles downgradient of the 160-Acre Area. The planned groundwater monitoring wells are in part intended to better define groundwater flow directions in this area. Of particular interest is obtaining 1) better definition of where in the Rialto-Colton basin groundwater (and any associated contamination) begins flowing more southerly or southwesterly and crosses the assumed location of the Rialto-Colton fault, rather than continuing to flow primarily to the southeast, and 2) information on groundwater flow conditions east-southeast of the Rialto 06 location where no data currently exists. Data collected from the new wells and sampling of existing wells will be used to prepare updated water level contour maps

3. Comment: [Page 2-6, 2nd paragraph, "Well locations are shown in Figure 2-1. These wells were all completed in the intermediate (B zone) aquifer that is variably saturated. Three deeper piezometers were installed into the deeper regional aquifer (C zone). The intermediate and regional aquifers are separated by a sequence of thin layers ranging in thickness from a few feet to more than 30 feet that act as aquitards, and significant groundwater elevation differences (over 150 feet) were observed between two aquifers.

Comment: A vertical gradient of 150 feet between the B zone and the C zone is quite large. If this is a downward vertical gradient, there is significant risk of cross contamination between wells which are screened in both zones. This may be the case for the long screened municipal wells and could affect the locations of the proposed multi-port monitoring wells.

Response: Only one of the planned wells, EPA-A, is located in an area where both the Intermediate and Regional Aquifers are expected. The other planned wells (EPA-B through EPA-G) are in areas where only the Regional Aquifer is present.

As described in Sections 5.1 and 5.1.3 of the draft FSP, several steps will be taken to minimize the risk of cross-contamination between zones:

> "All boreholes for MP wells will be advanced using the direct mud rotary drilling technique. Drilling mud will be used to minimize borehole collapse and to assist in evacuating drill cuttings from the boreholes. Drilling mud is expected to reduce the possibility of cross contamination between groundwater zones because it continuously invades the formation along the borehole walls and forms a low-permeability mud cake."
>
> "After completion of well construction, each screened interval will be developed by a combination of bailing, swabbing, and pumping. The drilling subcontractor will install temporary packers each night during well development, prior to installation of the Westbay packer system. This will significantly decrease the potential for cross contamination during well development."
>
> "It should be noted that the greatest risk of cross contamination exists after well development and before installation of the MP instrumentation. This potential for cross contamination will exist for approximately 24 hours (the time required to install and inflate the hydraulic packers the day after well development is completed). To minimize the potential for cross contamination, all efforts will be made to provide the MP instrumentation onsite prior to completion of well development. This will allow the MP instrumentation to be installed immediately after well development. If the MP instrumentation is not onsite upon the completion of well development, the temporary packers used during well development will be installed in the well until the MP instrumentation is ready for installation."

4. Comment: [Page 2-9, 2nd table, "Perchlorate ND"]

Please provide the laboratory detection limit here instead of ND.

Response: See revised table at end of document.

5. Comment: [Page 3-1, Section 3.1.1. Sampling Locations, "Figure 2-2 shows the locations of existing wells in the Rialto-Colton Basin…"]

It would be helpful here to use a different color symbol to highlight the wells to be sampled.

Response: See revised Figure 2-2 (attached) that uses a different color symbol to highlight which of the wells shown on the map are to be included in the upcoming sampling events.

6. Comment: [Page 3-3, 2nd paragraph, "The new MP monitoring wells are intended to better define groundwater flow directions and the lateral and vertical extent of contamination downgradient of the 160-Acre Area."]

Groundwater elevation contour maps would be helpful to define groundwater flow directions in each aquifer unit.

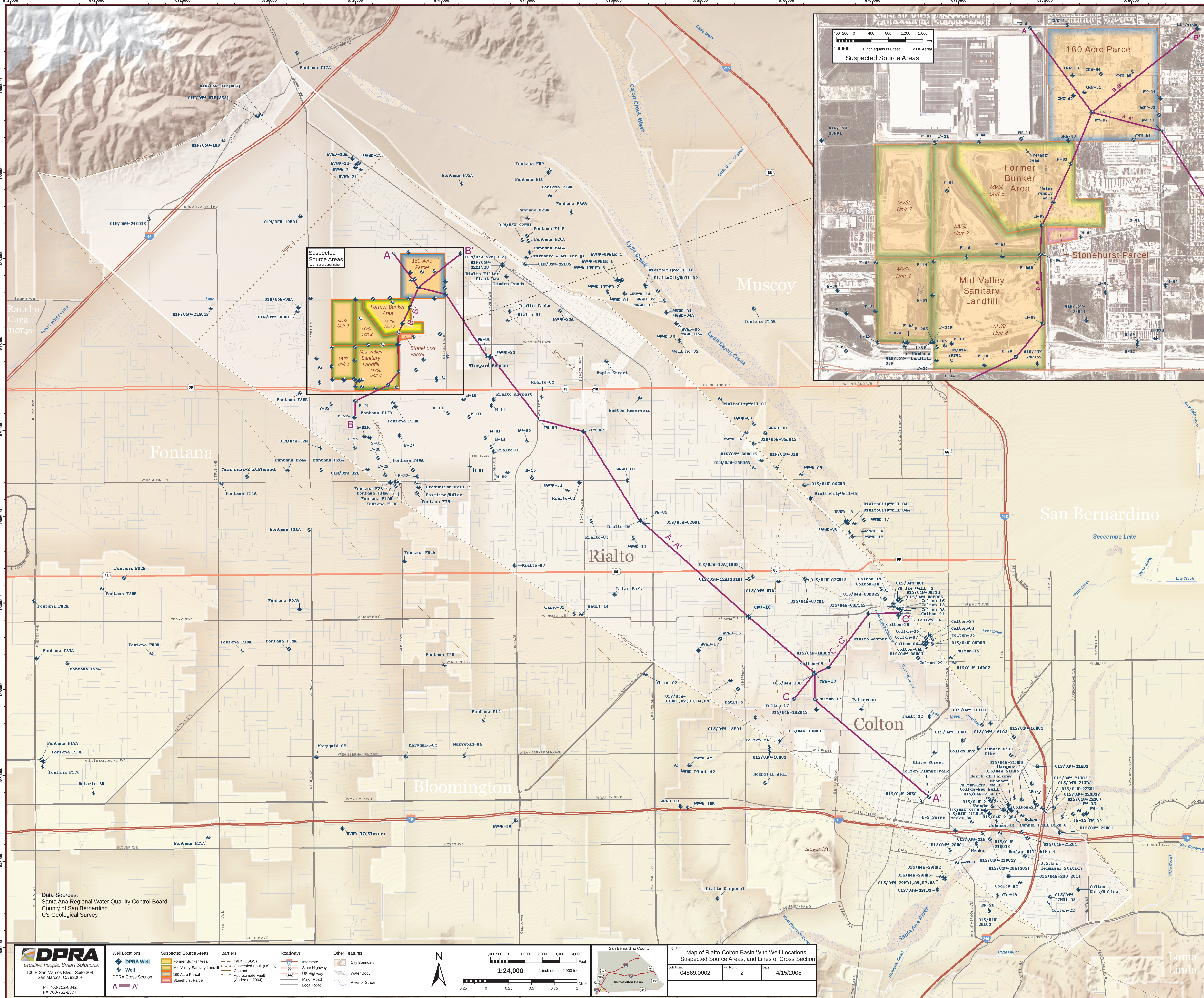
Response: See response to comment #2.

7. Comment: [Page 3-1, last paragraph, Section 3.1.1 Sampling Locations, "Up to 7 new MP monitoring wells…are planned to be installed…Figure 2-1 shows the potential location of the seven wells…"]

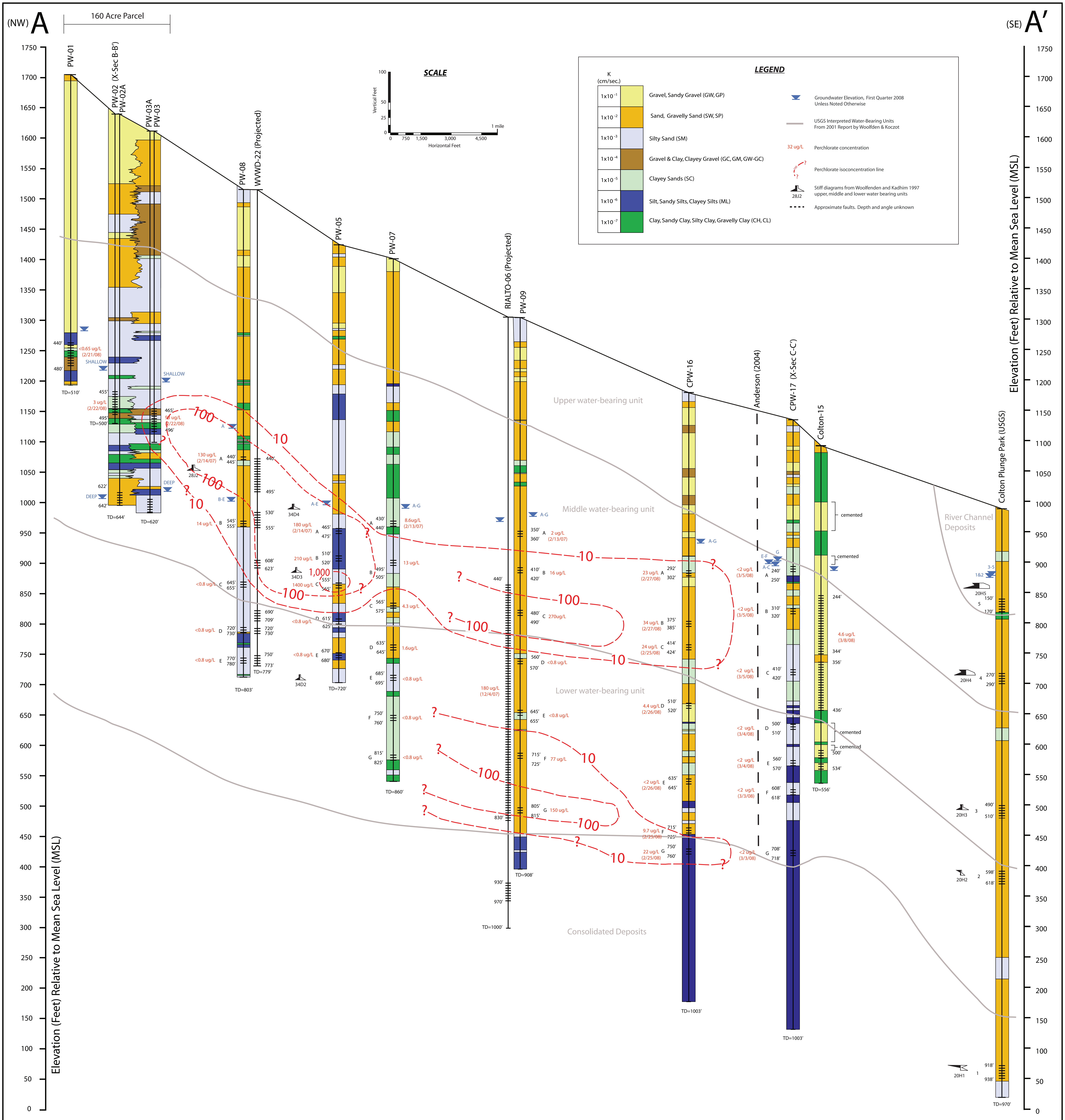
The proposed locations should also be illustrated on Figure 2-2 which shows the known extent of groundwater contamination.

Response: See revised Figure 2-2 (attached) which includes the subset of proposed new monitoring well locations that fall within the area depicted on the figure (EPA-A, EPA-B, and EPA-C).

Perchlorate Concentrations in Soil at the Former Goodrich Burn (April 2006)		
Sample ID	Depth (ft bgs)	Perchlorate (ug/kg)
SB-C-01-S5	5	<20
SB-C-01-S20	20	<20
SB-C-01-S20P	20	<20
SB-C-01-S25	25	<20
SB-C-02-S5	5	<20
SB-C-02-S10	10	<20
SB-C-02-S15	15	<20
SB-C-02-S20	20	<20
SB-C-02-S25	25	<20
SB-C-03-S5	5	<20
SB-C-03-S10	10	<20
SB-C-03-S15	15	<20
SB-C-03-S20	20	<20
SB-C-03-S25	25	<20
SB-C-04-S5	5	750 J
SB-C-04-S10	10	720 J
SB-C-04-S15	15	170 J
SB-C-05-S5	5	<20
SB-C-05-S10	10	<20
SB-C-05-S15	15	28 J
SB-C-05-S20	20	39
SB-C-05-S25	25	64 J
SB-C-06-S5	5	300
SB-C-06-S10	10	370
SB-C-06-S15	15	760 J
SB-C-07-S5	5	<20
SB-C-07-S10	10	<20
SB-C-07-S15	15	<20
SB-C-07-S20	20	<20
SB-C-07-S25	25	<20
SB-C-08-S5	5	<20
SB-C-08-S10	10	<20
SB-C-08-S15	15	23 J
SB-C-08-S20	20	170
SB-C-08-S25	25	28 J
Source: Environ, 2008		



Suspected Source Areas
160 Acre Parcel
Former Bunker Area
MVSL Unit 1
MVSL Unit 2
MVSL Unit 3
MVSL Unit 4
MVSL Unit 5
Mid-Valley Sanitary Landfill
Stonehurst Parcel
Fontana
Rialto
Colton
Muscoy
San Bernardino
Bloomington
Rancho Cucamonga
Loma Linda
Data Sources:
Santa Ana Regional Water Quarlity Control Board
County of San Bernardino
US Geological Survey
DPRA
Creative People. Smart Solutions.
100 E San Marcos Blvd., Suite 308
San Marcos, CA 92069
PH 760-752-8342
FX 760-752-8377
Well Locations
DPRA Well
Well
DPRA Cross Section
A A'
Suspected Source Areas
Former Bunker Area
Mid Valley Sanitary Landfill
160 Acre Parcel
Stonehurst Parcel
Barriers
Fault (USGS)
Concealed Fault (USGS)
Contact
Approximate Fault (Anderson 2004)
Roadways
Interstate
State Highway
US Highway
Major Road
Local Road
Other Features
City Boundary
Water Body
River or Stream
1:24,000
1 inch equals 2,000 feet
San Bernardino County
Rialto-Colton Basin
Fig Title:
Map of Rialto-Colton Basin With Well Locations, Suspected Source Areas, and Lines of Cross Section
Job Num:
04569.0002
Fig Num:
2
Date:
4/15/2008



Colton A-A' Cross Section

DPRA
Creative People. Smart Solutions.
100 E San Marcos Blvd., Suite 308
San Marcos, CA 92069
PH 760-752-8342
FX 760-752-8377

Job Number: 4569.0002

Figure Number: 3A

Date Created: 07/27/2007

Revision Date: 04/15/2008

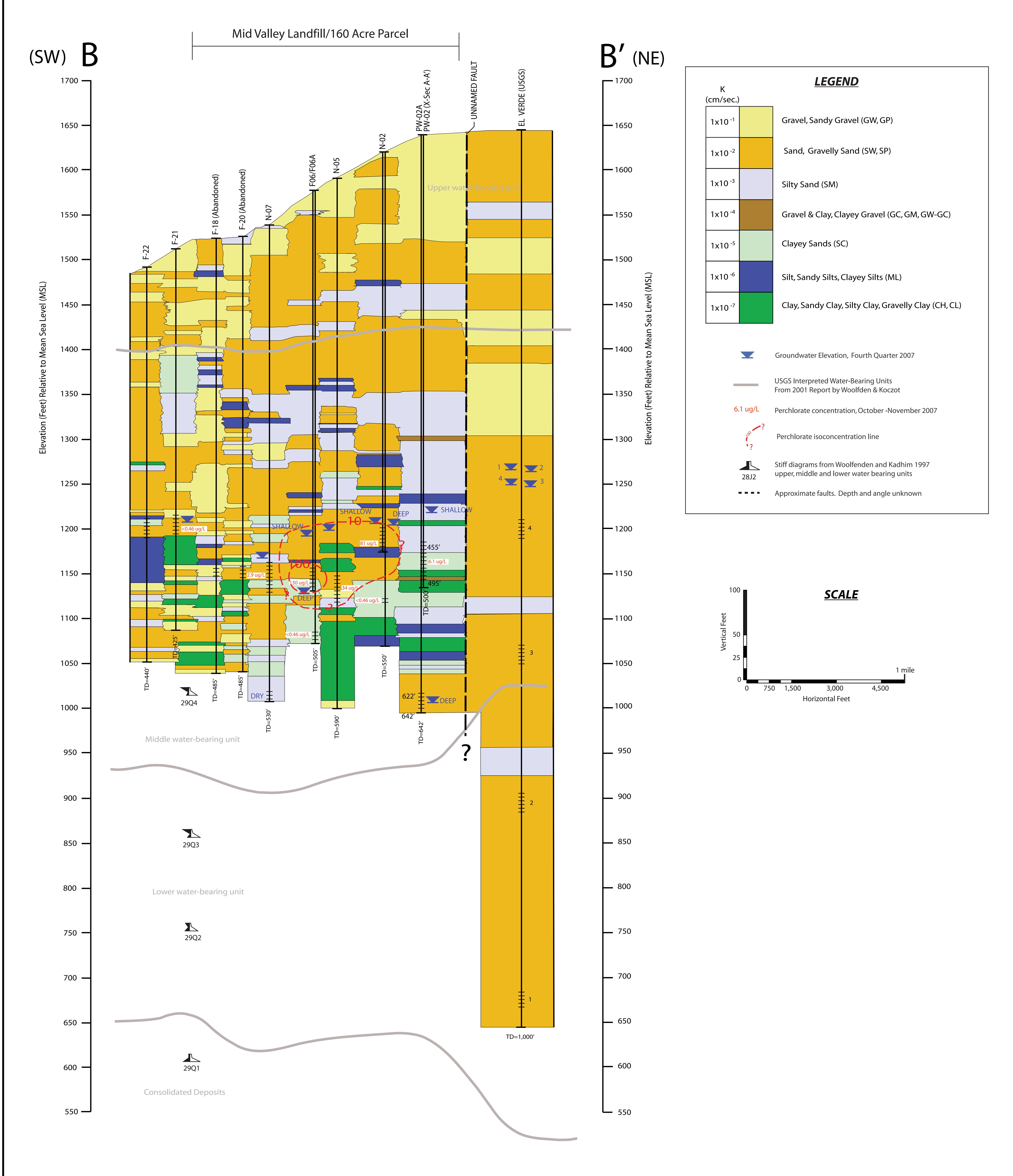


Figure Title

Colton B-B' Cross Section

DPRA
Creative People. Smart Solutions.

100 E San Marcos Blvd., Suite 308
San Marcos, CA 92069
PH 760-752-8342
FX 760-752-8377

Job Number: 4569.0002	Figure Number: 3B	
Path:	Date Created: 07/27/2007	Revision Date: 04/15/2008

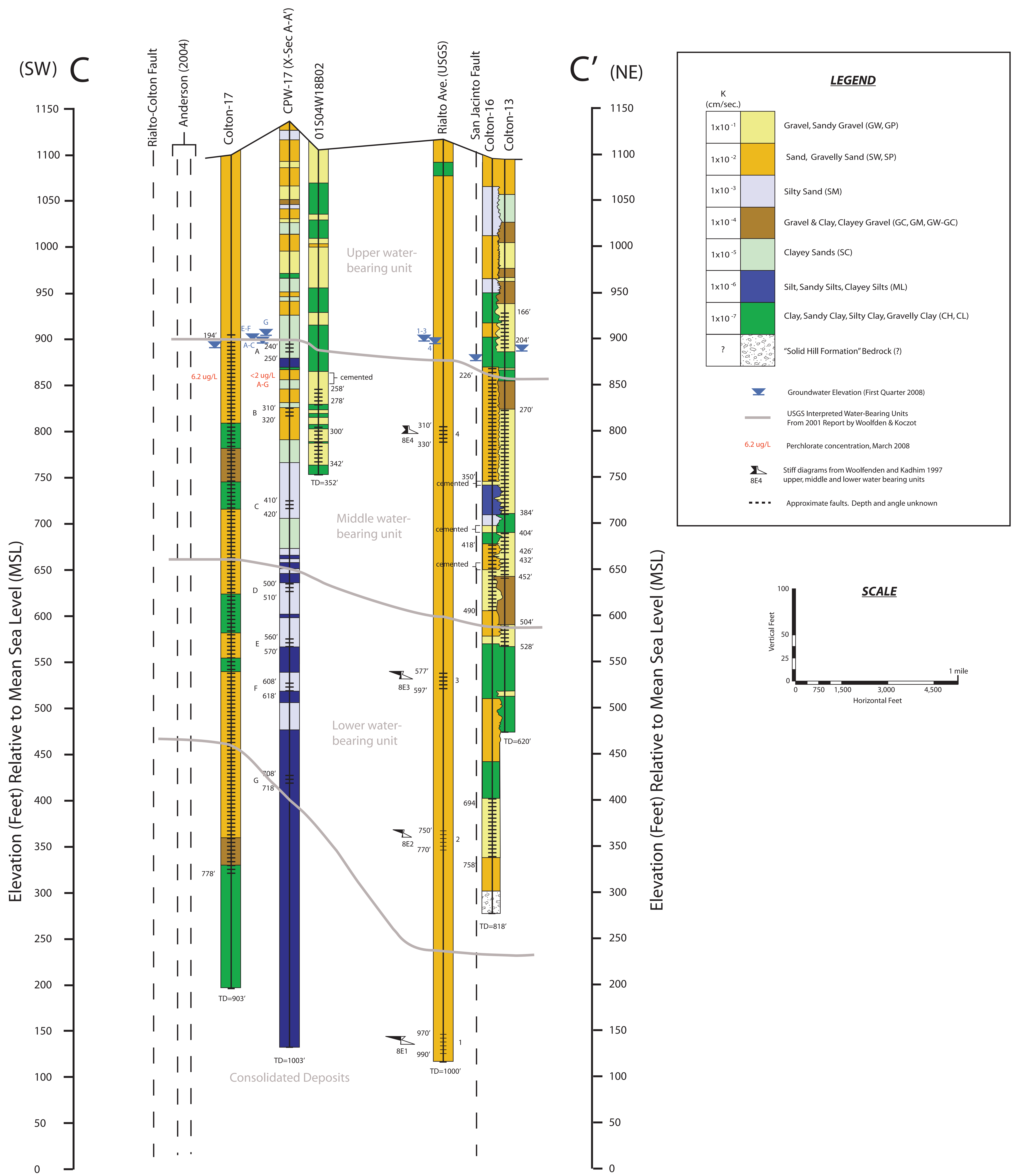


Figure Title

Colton C-C' Cross Section

DPRA
Creative People. Smart Solutions.

100 E San Marcos Blvd., Suite 308
San Marcos, CA 92069
PH 760-752-8342
FX 760-752-8377

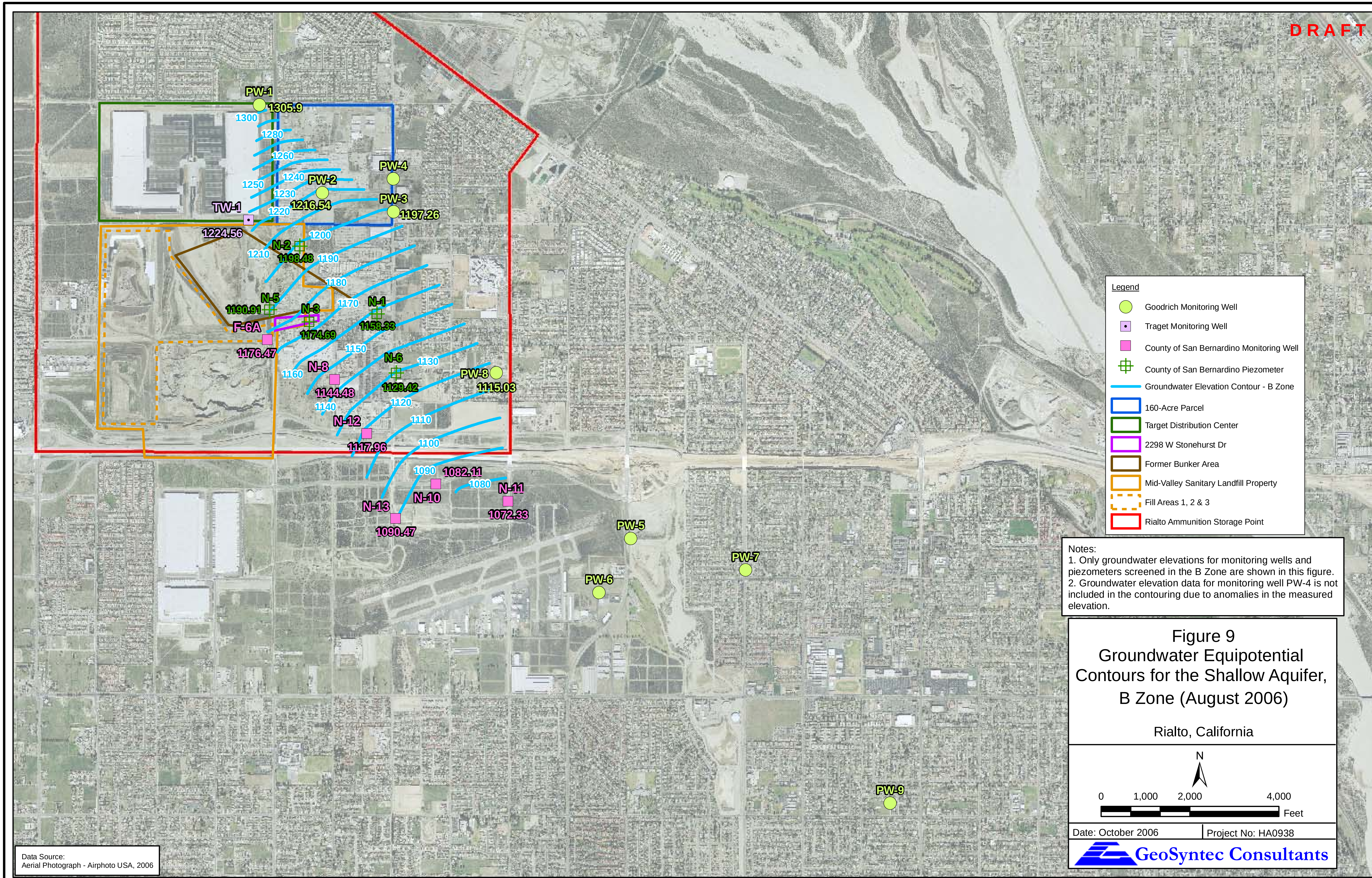
Job Number: 4569.0002

Path:

Figure Number: 3C

Date Created: 07/27/2007

Revision Date: 04/15/2008



P:\GIS\HA0938\PROJECTS\20060920\EquipotentialContour_ZoneB_20060922_B.mxd KNP 20060922

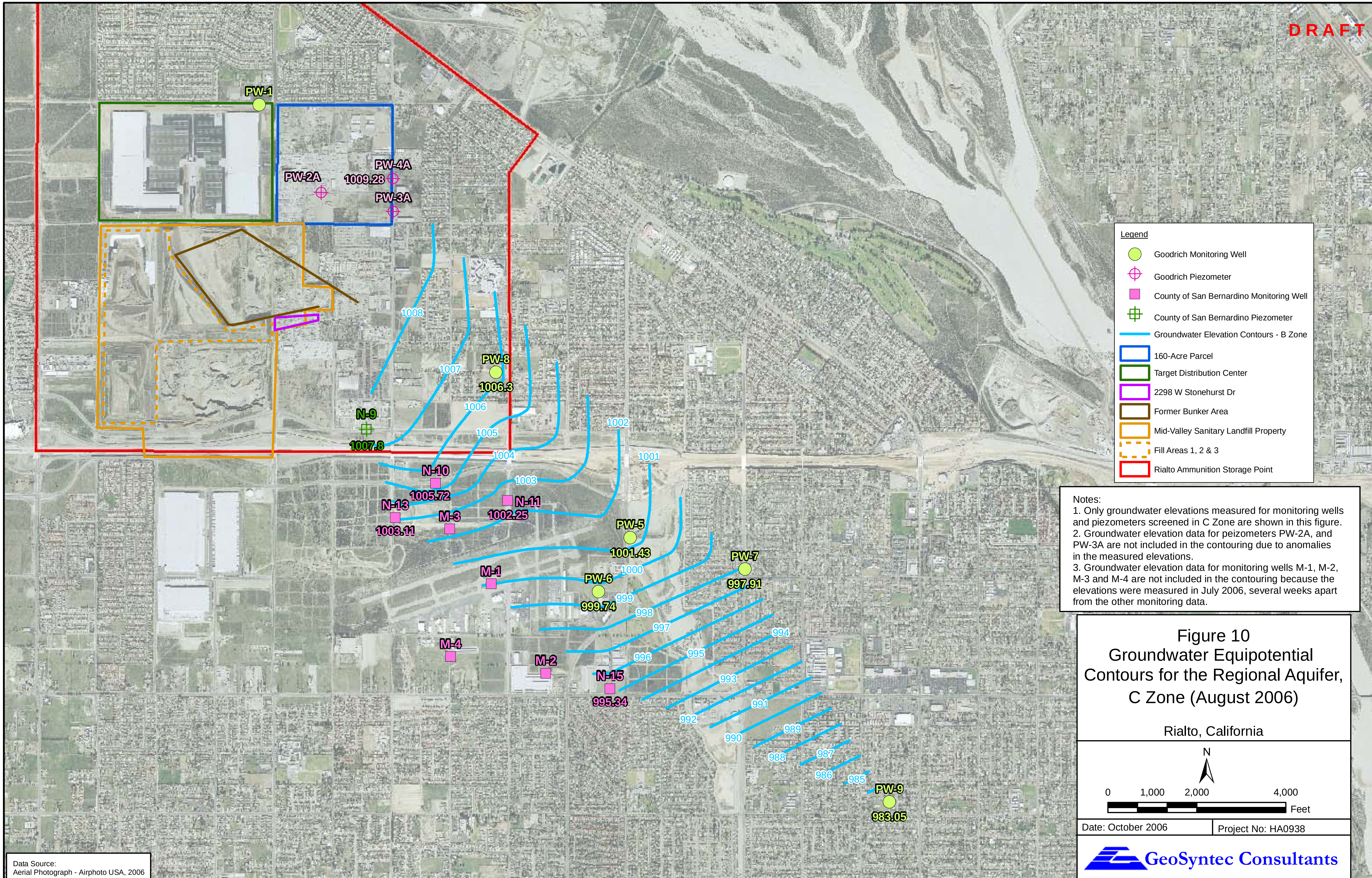


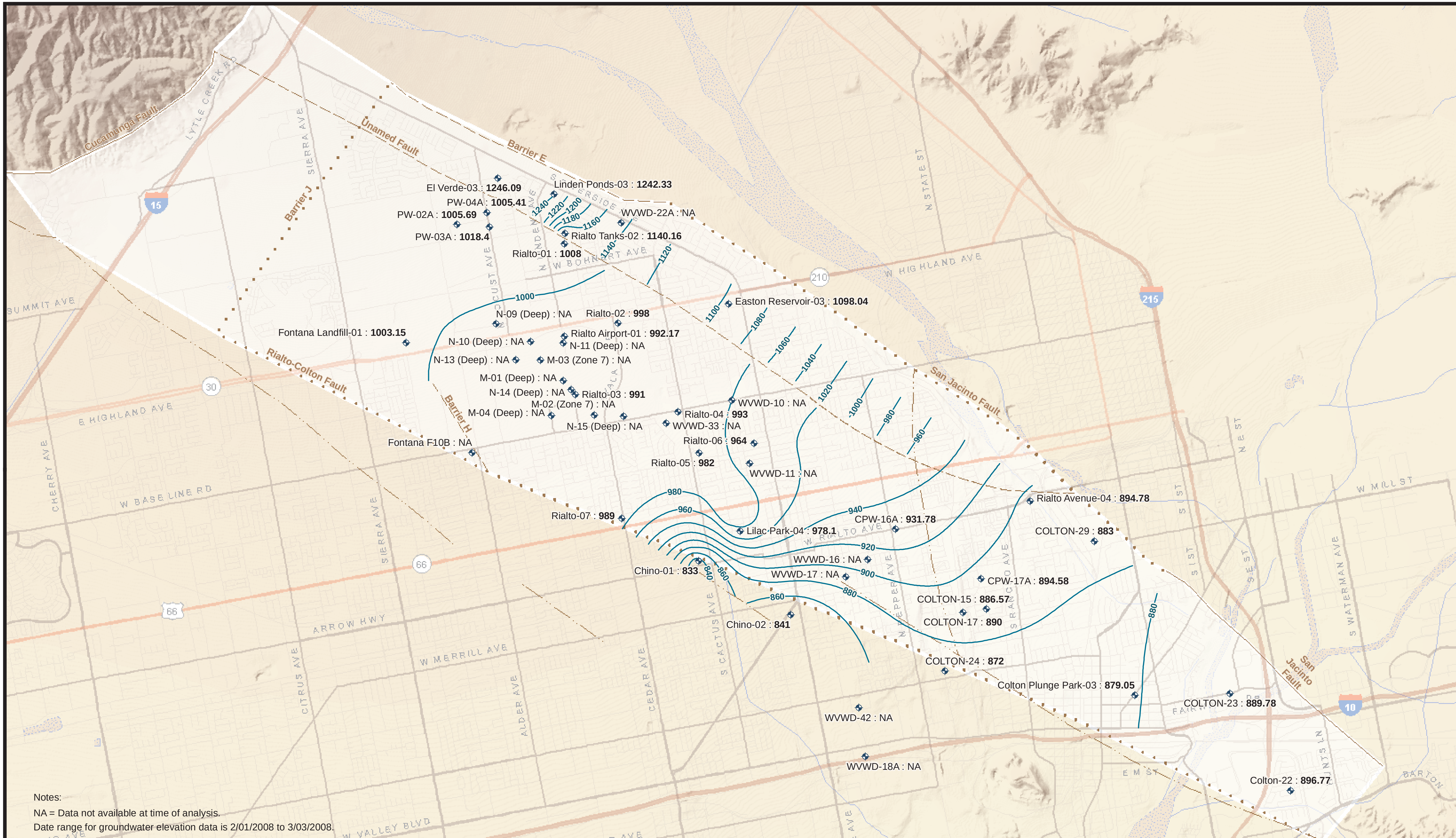
Figure 10
Groundwater Equipotential Contours for the Regional Aquifer, C Zone (August 2006)

Rialto, California

Date: October 2006 | Project No: HA0938

GeoSyntec Consultants

P:\GIS\HA0938\PROJECTS\20060920\EquipotentialContour_ZoneB_20060922_C.mxd KNP 20060922



Notes:

NA = Data not available at time of analysis.

Date range for groundwater elevation data is 2/01/2008 to 3/03/2008.

Suspected Source Areas
- Former Bunker Area
- Mid Valley Sanitary Landfill
- 160 Acre Parcel
- Stonehurst Parcel

Barriers
- Fault (USGS)
- Concealed Fault (USGS)
- Contact
- Approximate Fault (Anderson 2004)

Hydrological
- Groundwater Elevation Contour
- Gauging Well
- River or Stream
- Water Body

N

-10 degrees rotation

4,500 0 4,500 Feet

1:54,000 1 inch equals 4,500 feet

0.5 0.25 0 0.5 1 Miles

Fig Title: Groundwater Elevation Contours Colton-Rialto Basin. February-March 2008		
Job Num: 04569.0002	Fig Num: 4d	Date: 4/15/2008

DPRA
Creative People. Smart Solutions.
100 E San Marcos Blvd., Suite 308
San Marcos, CA 92069

PH 760-752-8342
FX 760-752-8377

Appendix D
EPA Approval Signature Page

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION IX

Sample Plan Title: Field Sampling Plan – Groundwater Characterization Sampling

Site Name: BF Goodrich Site

Site Location: San Bernardino County

City/State/Zip: San Bernardino County, California

Site EPA ID#: 09JW

Anticipated Investigation Dates: February 2009 – April 2011

Prepared By: David Towell — December 2008 Date

Agency or Firm: CH2M HILL, Inc.

Address: 1000 Wilshire Blvd., 21st Floor

City/State/Zip: Los Angeles, California 90017

Telephone: (213) 228-8285

EPA Project Manager: Wayne Praskins Section: SFD-7-3 415/972-3181 Phone No.

FSP Approval Date:

* *

S U P E R F U N D

(for EPA use)

Received by Superfund Remedial Project Manager: 3/4/09 Date

Reviewed by: Wayne Praskins Date

APPROVED / NOT APPROVED

S U P E R F U N D

* *

Q A O

Expedited Review? Yes/No

Received by Quality Assurance Office: Date

Reviewed by: Beth Freitas, 3/4/09 Date

Approved: Eugenia McNaughton 3/4/09 Date

Manager, Quality Assurance Office,
Management and Technical Services Division

Q A O

* *

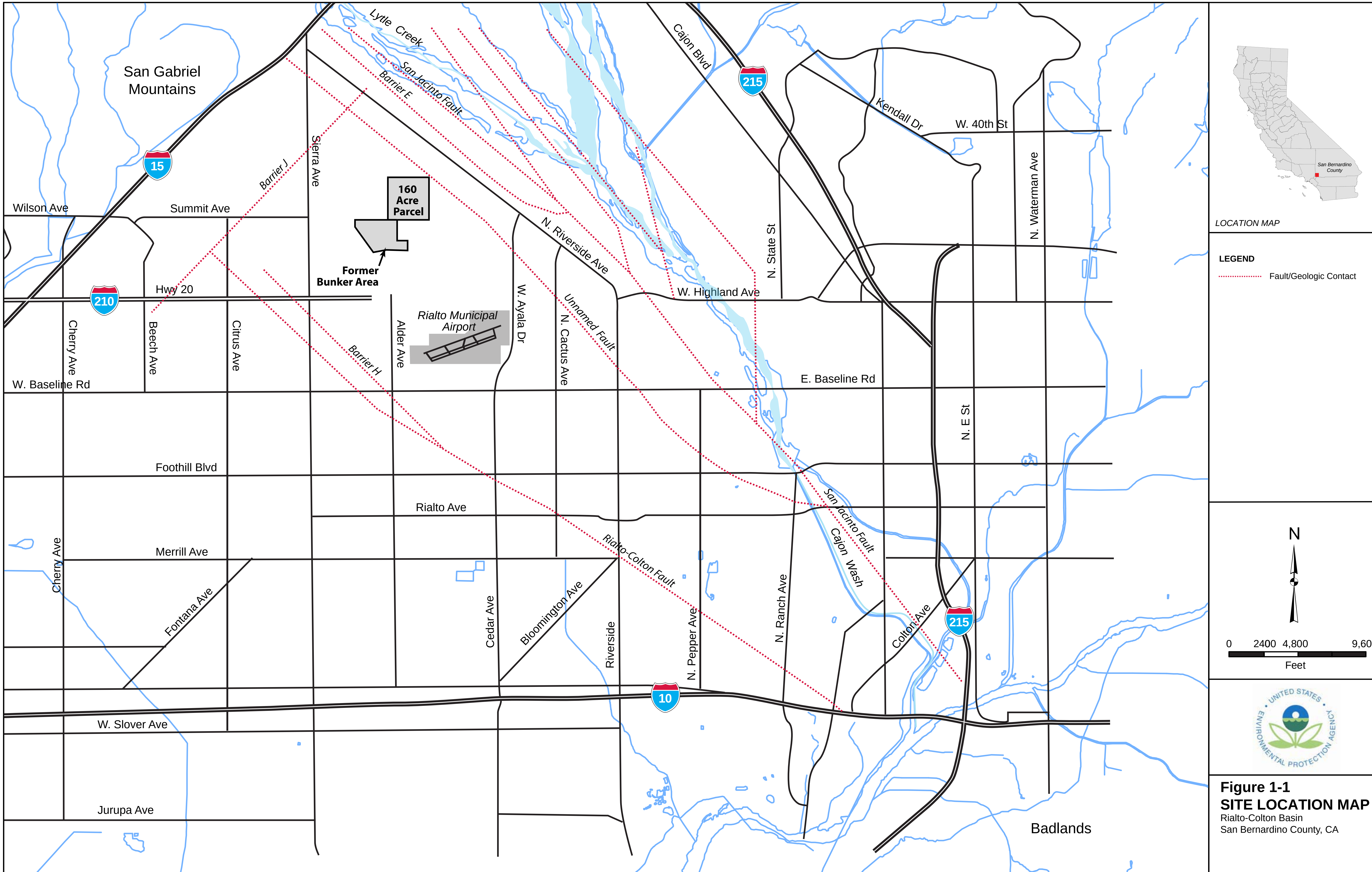
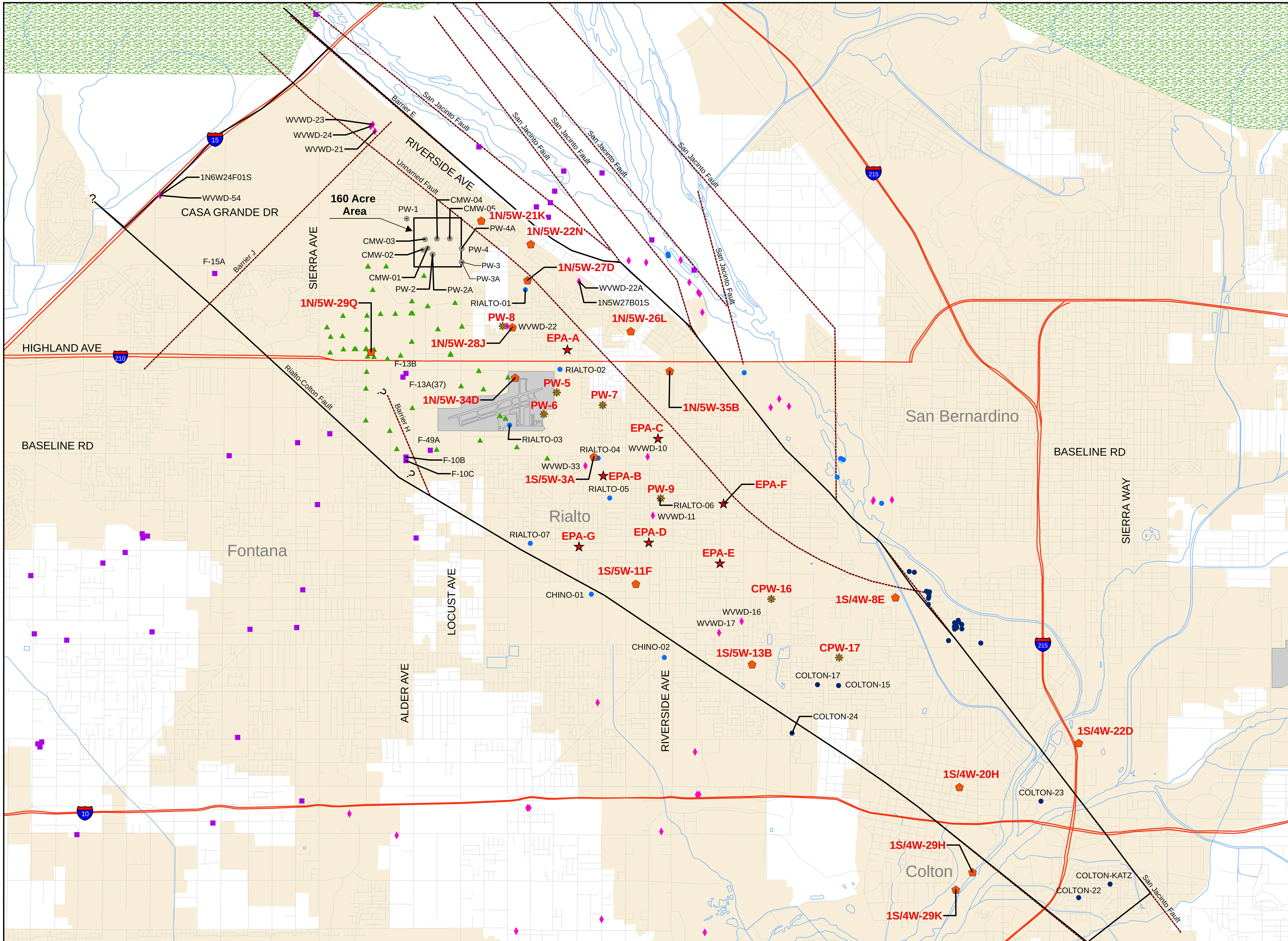
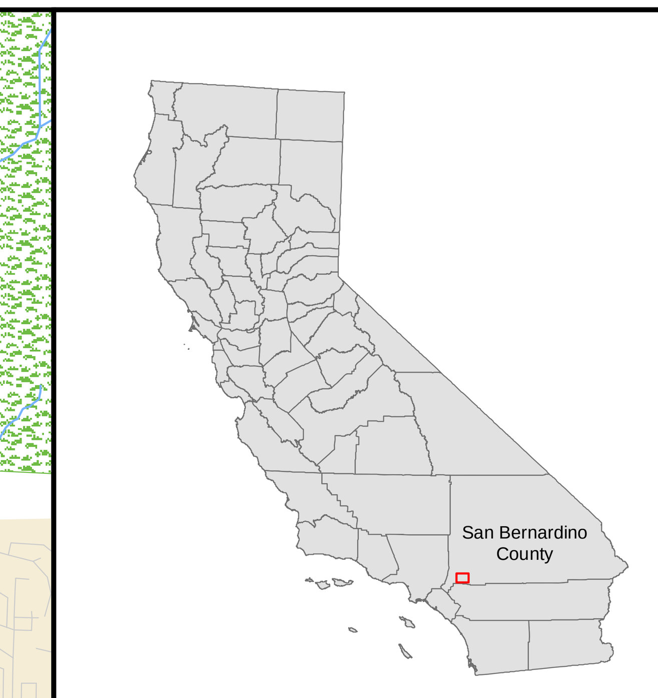


Figure 1-1
SITE LOCATION MAP
Rialto-Colton Basin
San Bernardino County, CA





LOCATION MAP

LEGEND

- 160-Acre Area Monitoring Well
- 160-Acre Area - Downgradient Monitoring Well
- Potential 160-Acre Area - Downgradient MW
- City of Colton Production Well
- City of Rialto Production Well
- Fontana Water Company Production Well
- San Bernardino County MVSL Wells
- West Valley Water District Production Well
- USGS Well
- Approximate Basin Boundary
- Faults/Geologic Contact
- Roads
- Airports
- Parks
- Cities

N

0 2,500 5,000

Feet

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIGURE 2-1
WELL LOCATION MAP

Rialto-Colton Basin
San Bernardino County, CA

CH2MHILL

\\MADISON\GROUPS\EMS\GIS_LIBRARY\RIALTO-COLTON\MAPFILES\REPORT_MAPFILES\012709\FIGURE2-1_WELLSLOCATIONS_SIZED.MXD CVF CVONFREE 3/5/2009 11:42:56

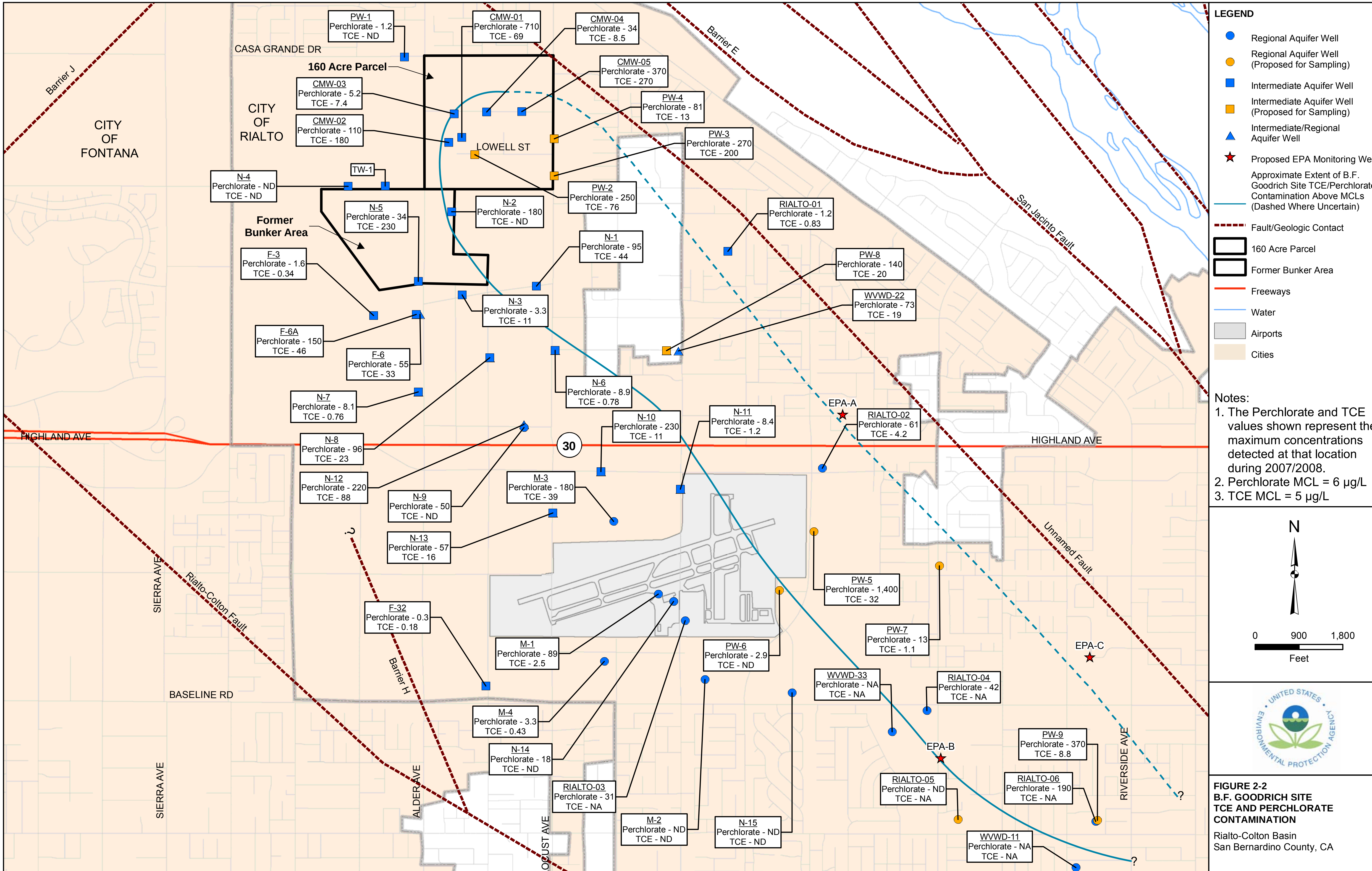
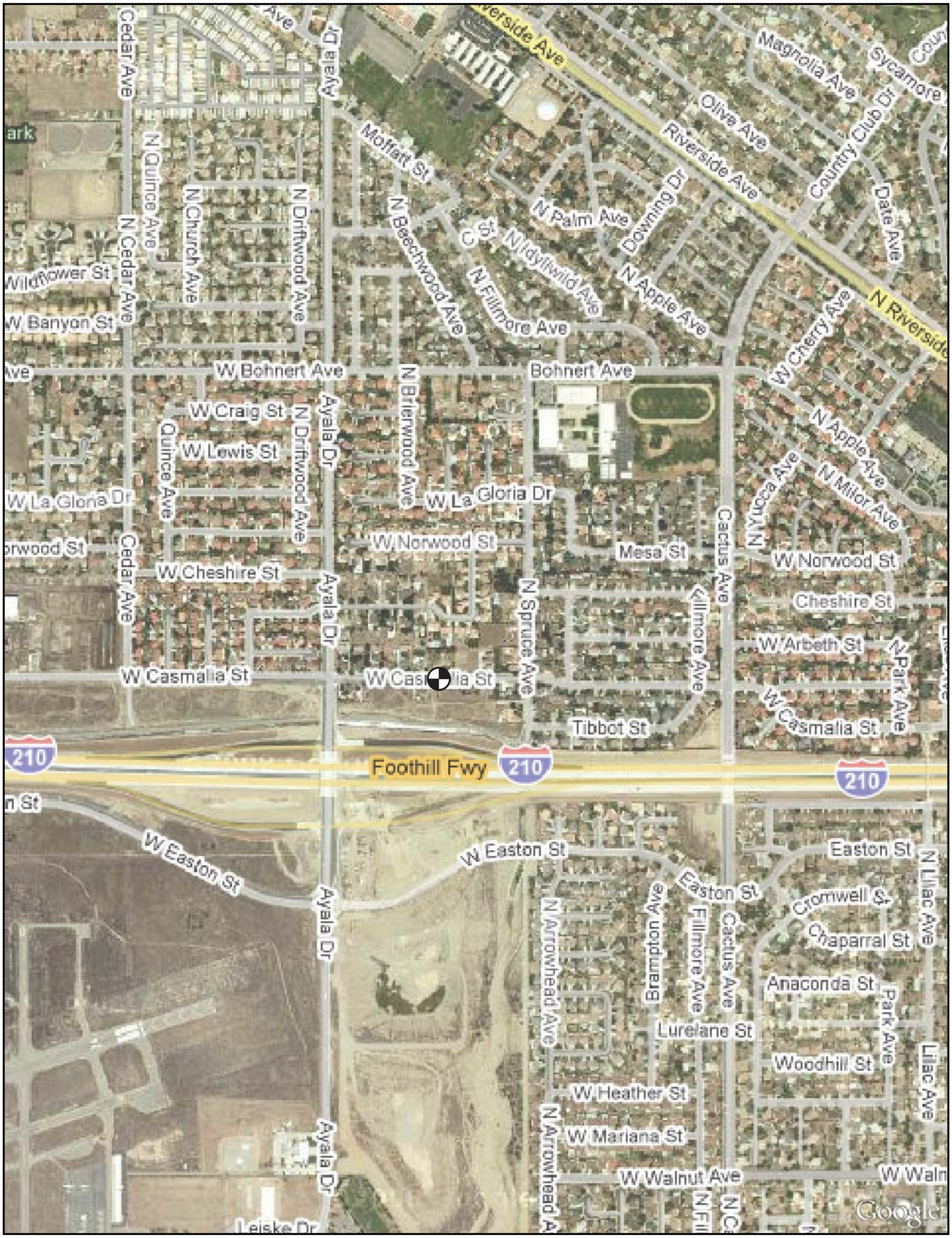


FIGURE 2-2
B.F. GOODRICH SITE
TCE AND PERCHLORATE CONTAMINATION
Rialto-Colton Basin
San Bernardino County, CA

\\MADISON\GROUPS\EMS\GIS_LIBRARY\RIALTO-COLTON\MAPFILES\REPORT_MAPFILES\081808\FIGURE2-2_160ACRE_PARCEL_TCE_PERCHLORATE.MXD CVF CVONFREE 2/26/2009 22:05:35



= Target Well Location

North

0 500 1,000

Approximate scale in feet

FIGURE 2-4
Potential Drilling Location for Well EPA-A

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

CH2MHILL

= First Choice Drilling Location = Second Choice Drilling Location = Third Choice Drilling Location = Target Well Location

North 0 250 500 Approximate scale in feet

FIGURE 2-5
Potential Drilling Locations for Well EPA-B

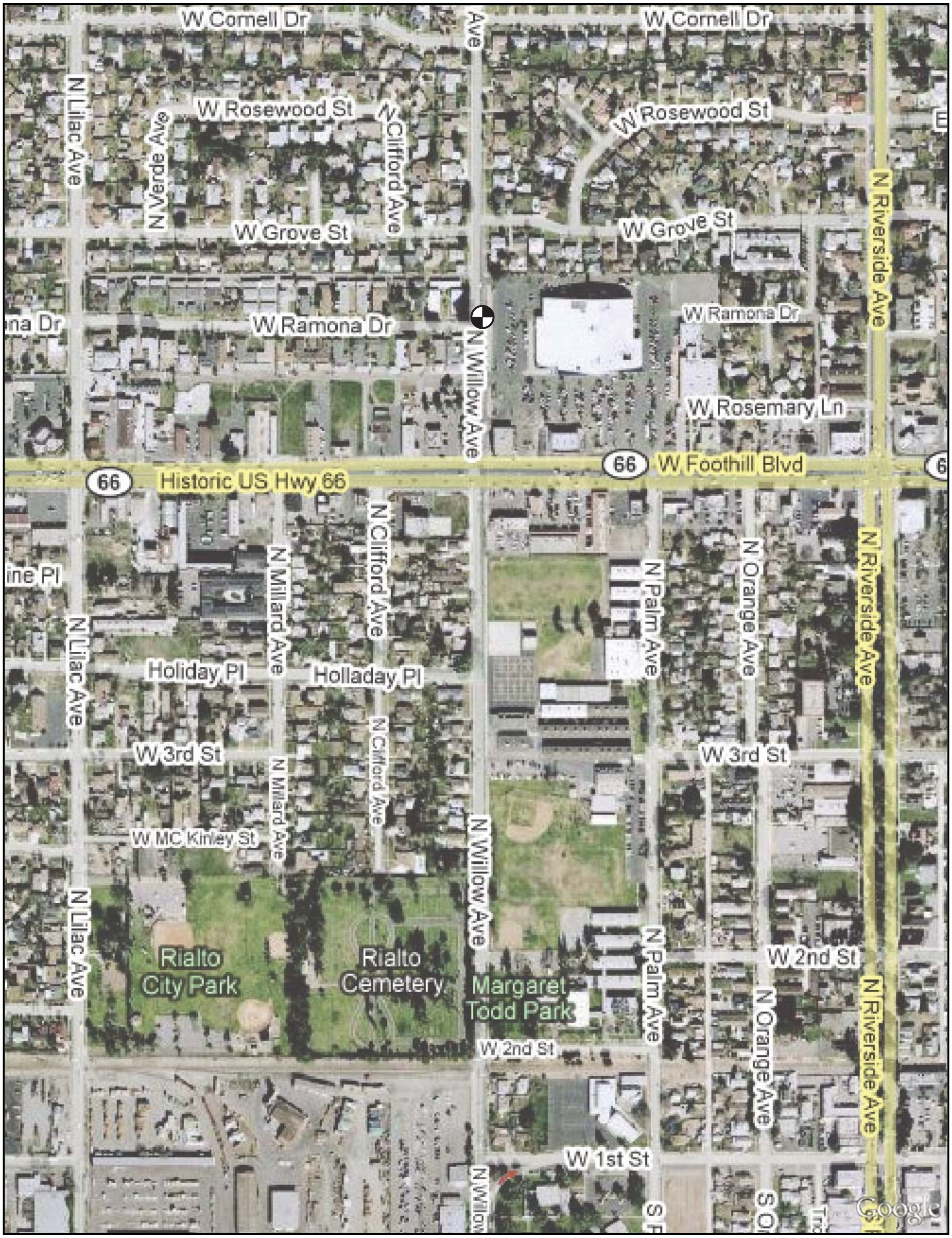
Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

CH2MHILL

FIGURE 2-6
Potential Drilling Location for Well EPA-C

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

CH2MHILL



= Target Well Location

North

0 250 500

Approximate scale in feet

FIGURE 2-7
Potential Drilling Location for Well EPA-D

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

CH2MHILL

FIGURE 2-8
Potential Drilling Location for Well EPA-E

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

CH2MHILL

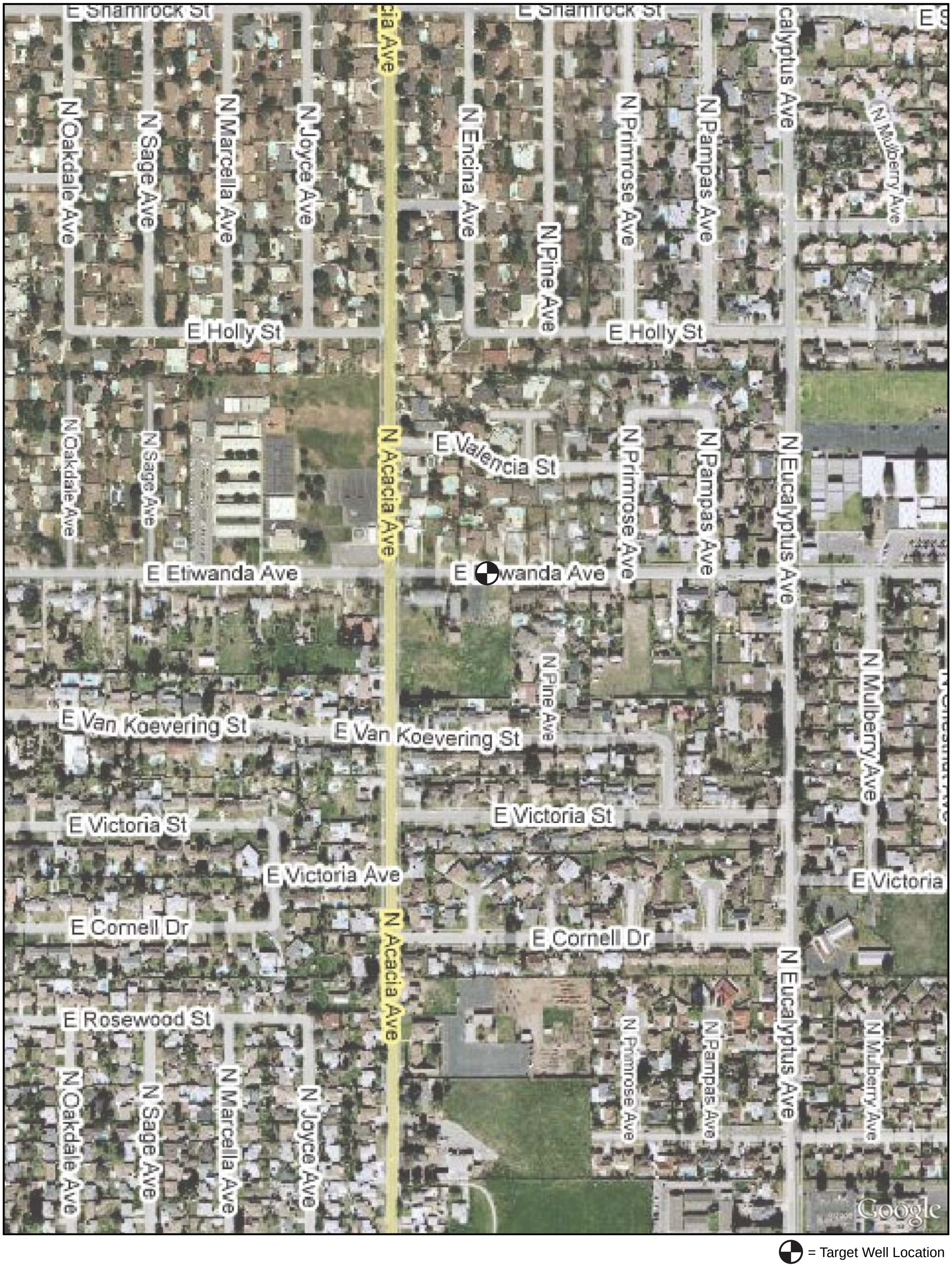


FIGURE 2-9
Potential Drilling Location for Well EPA-F

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.

CH2MHILL

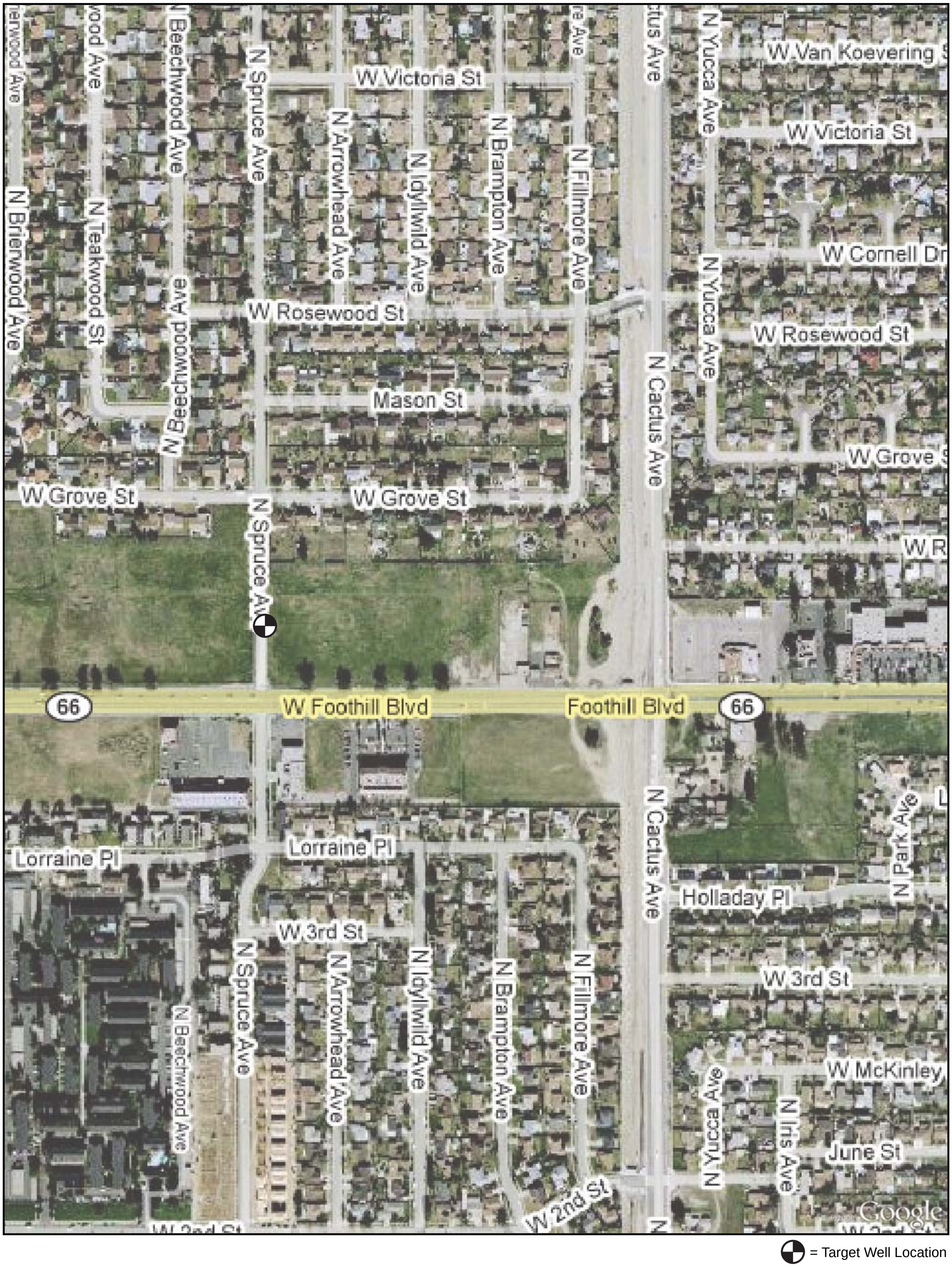
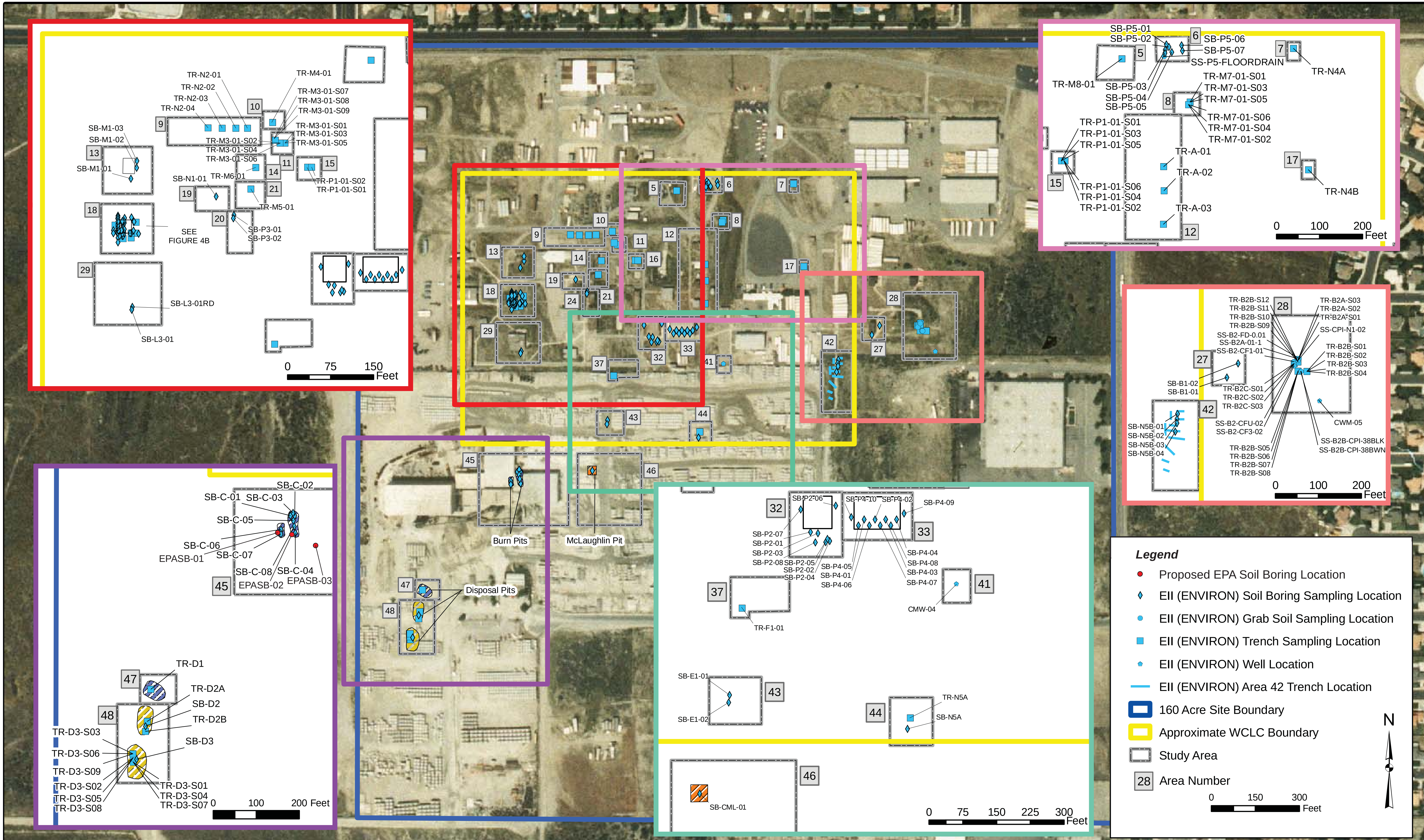


FIGURE 2-10
Potential Drilling Location for Well EPA-G

Aerial image © Google Earth, 2008. Annotation by CH2M HILL, 2008.



Source: Environ, Figure 4A, Remedial Investigation Report, 160-Acre Site, Rialto, CA, September 2008

Figure 2-11
Soil Boring Location Map
Rialto-Colton Basin
San Bernardino County, CA

CH2MHILL

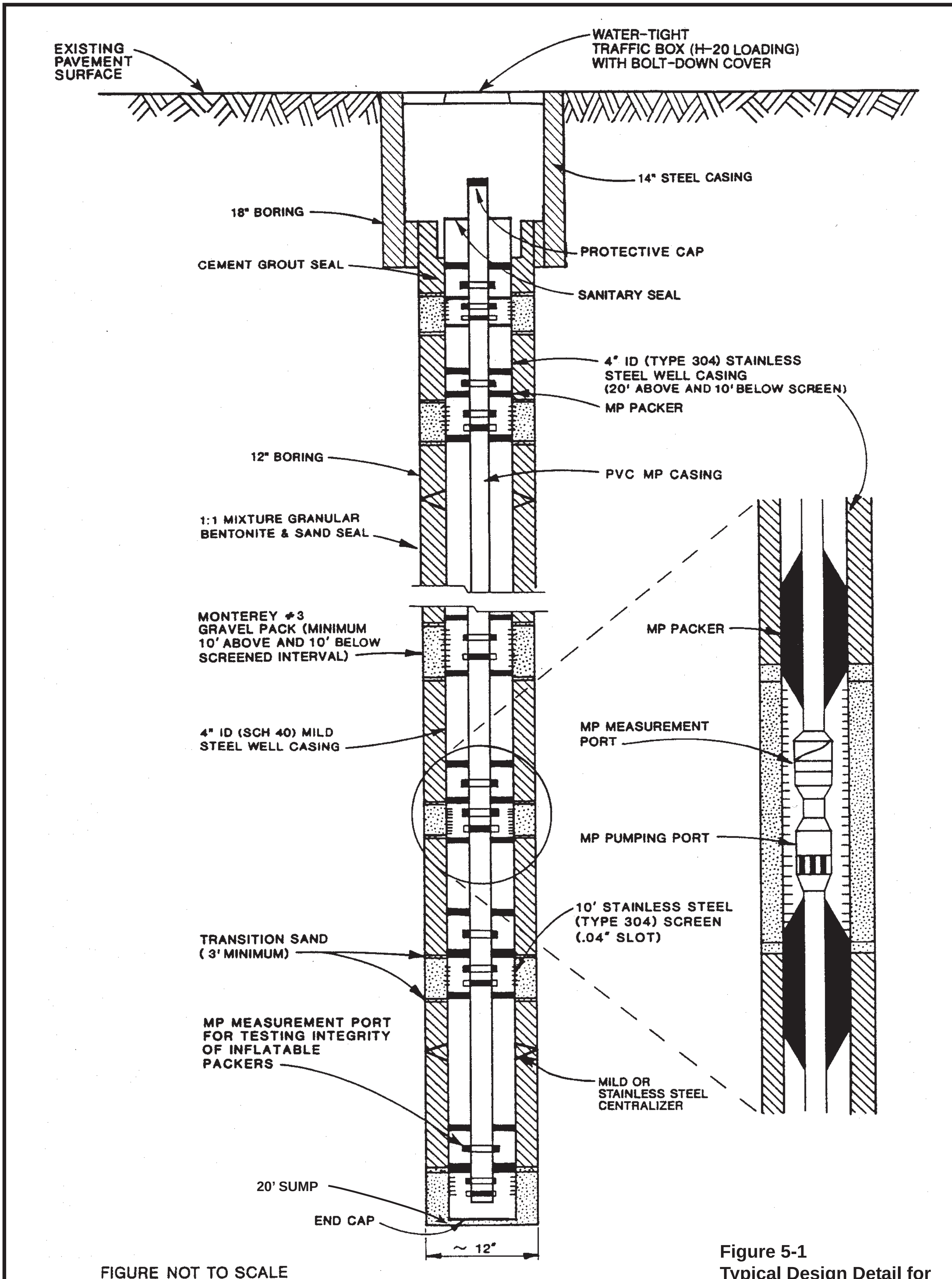
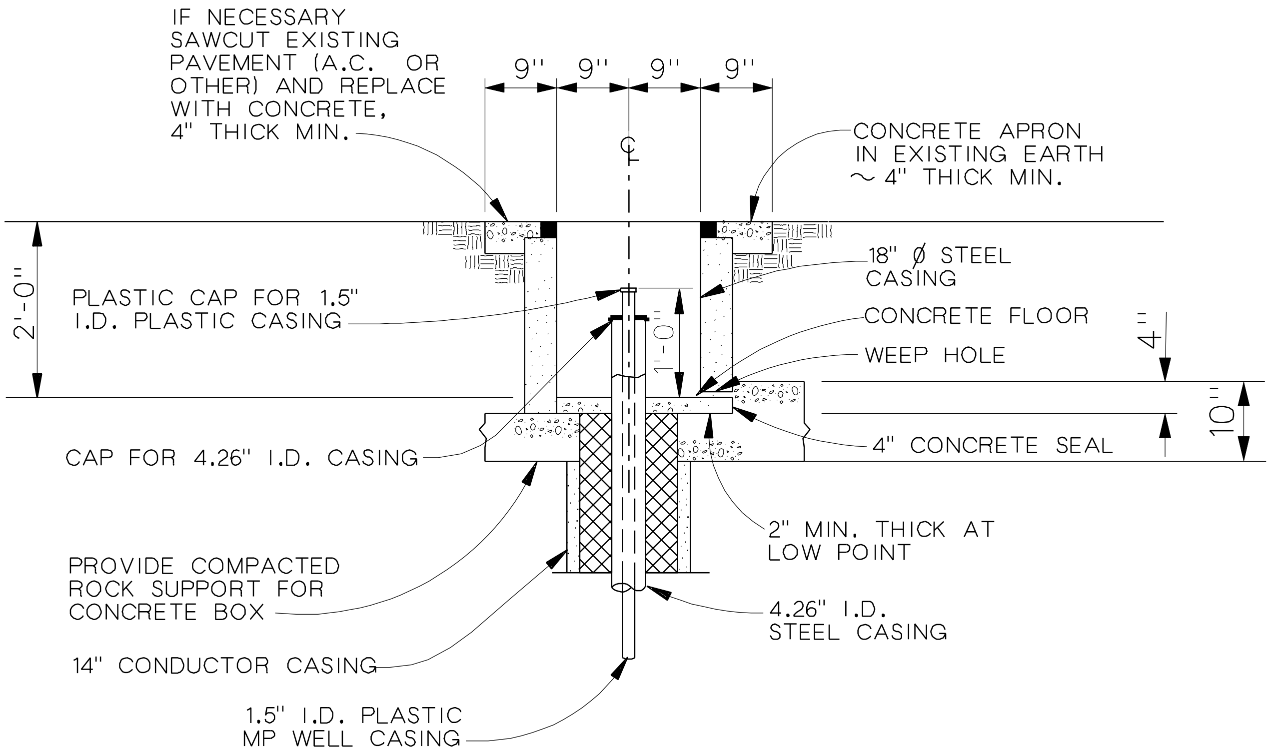
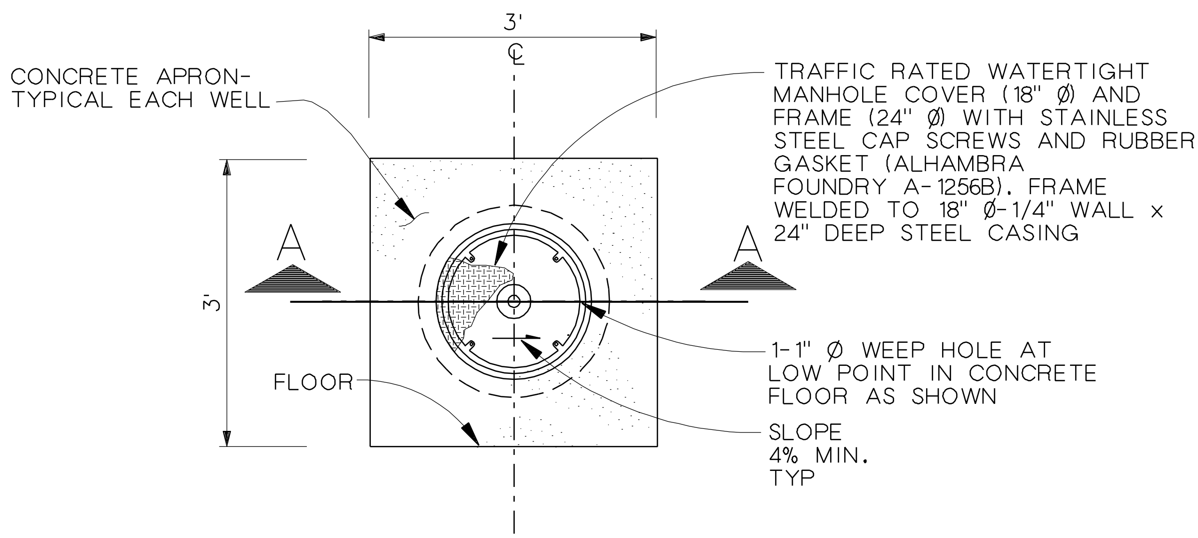


Figure 5-1
Typical Design Detail for Multi-Port Monitoring Well



SECTION A-A

1/2''=1'



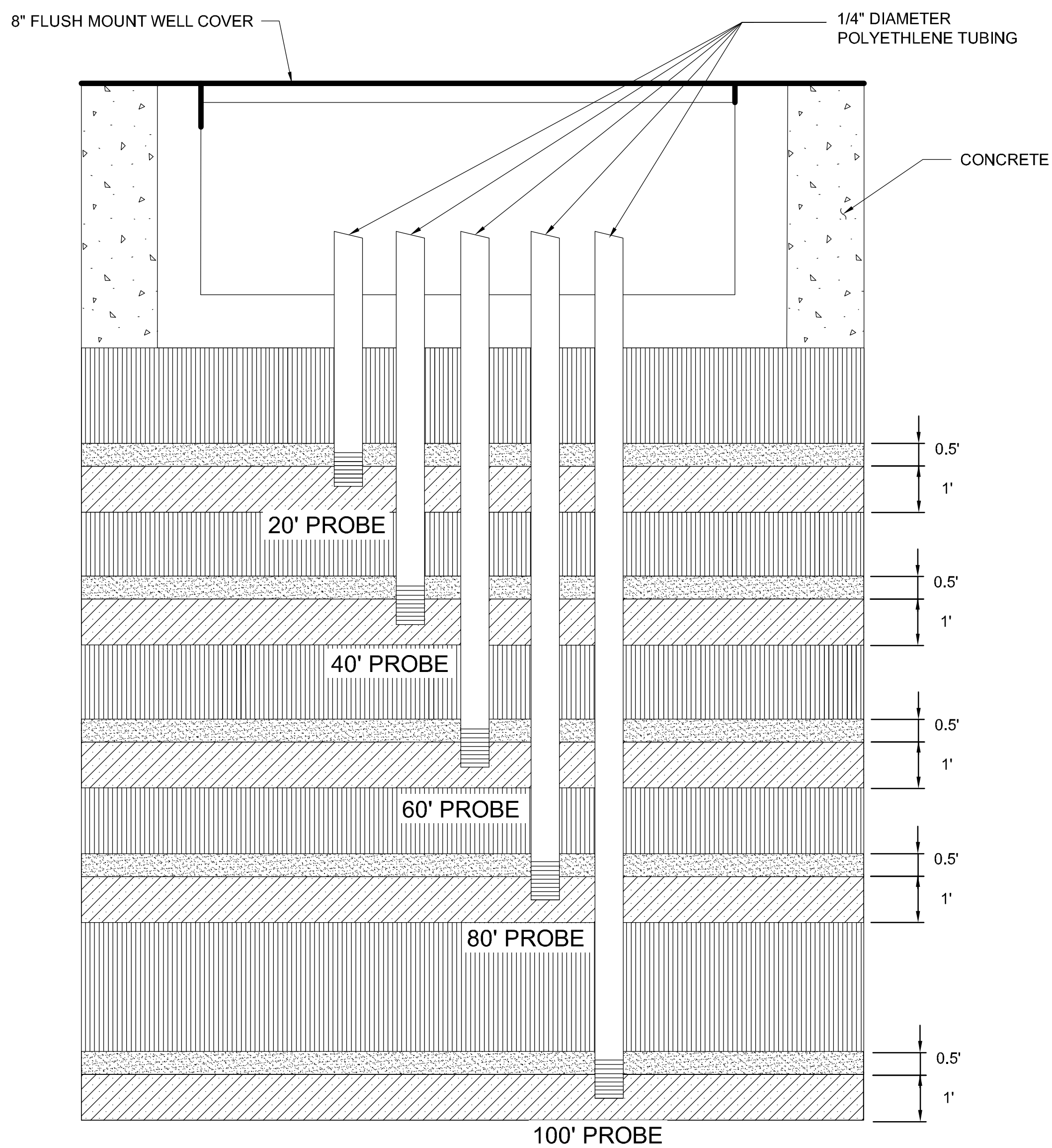
VAULT AND PIPE ASSEMBLY DETAIL

1

1/2''=1'

Figure 5-2
Below Grade
Surface Closure
Construction Details
For Monitoring Wells

NDM-SCO:WALK UP WORK\RIALTO\ 381696_Details.dgn PLOT DATE: 12/19/2008 PLOT TIME: 11:15:39 AM



LEGEND

GRANULAR BENTONITE

COARSE SAND

FINE SAND

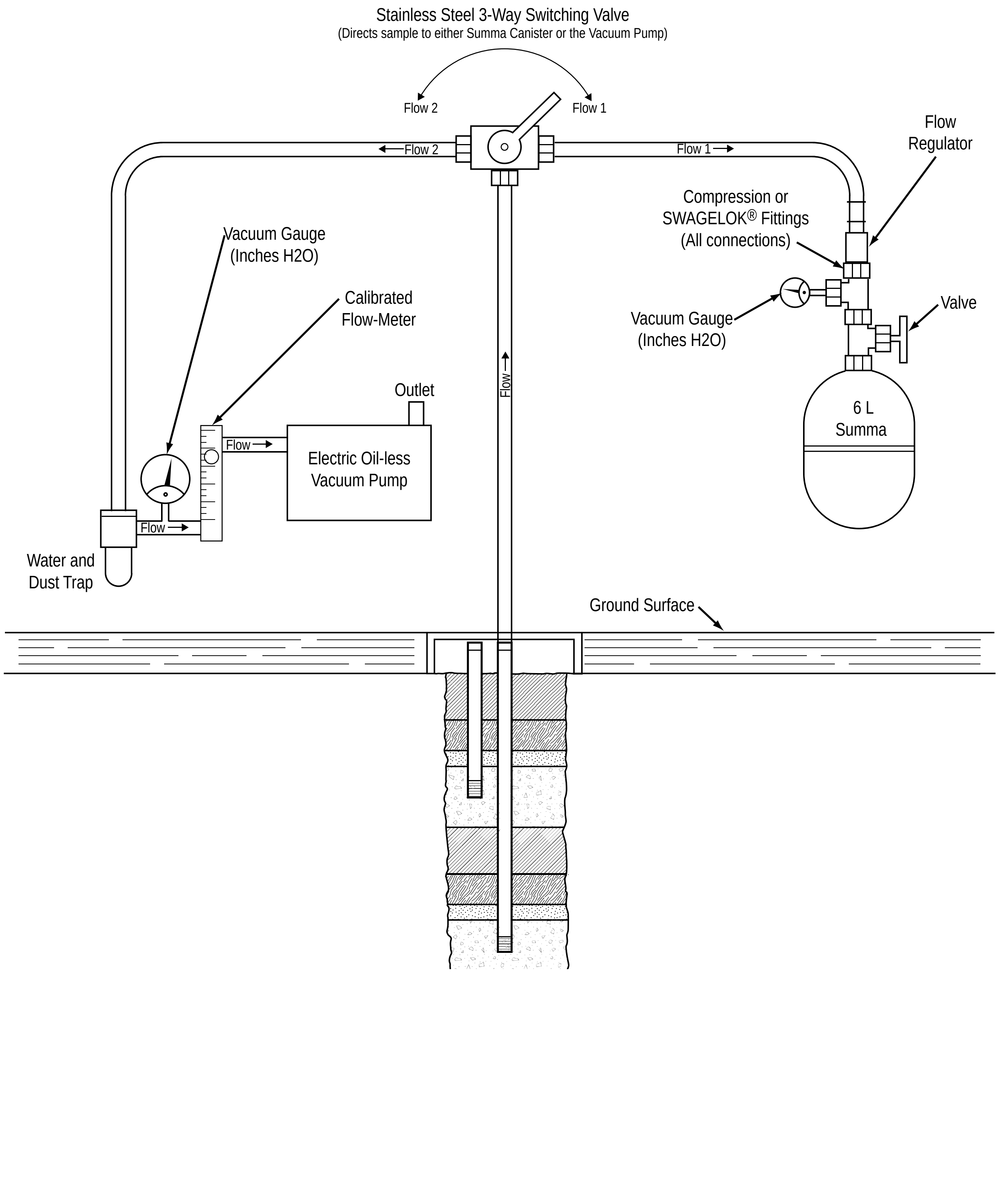
CONCRETE

6' STAINLESS STEEL PROBE TIP

Figure 5-3
TYPICAL SOIL GAS PROBE SCHEMATIC

NOT TO SCALE

NDM-SCO:WALK UP WORK\RIALTO\ 381696_SOIL VAPOR WELL01.dwg Dec 19, 2008 - 11:18am



Note:
Figure modified from
Environmental Support Technolgies, Inc.
Irvine, CA. 10-26-05

Figure 5-4
Typical Soil Gas Sampling System

CH2MHILL

SCO381696.BF.SA PV_sampsys2.ai 12/08